THE

FOUNDRY TRADE JOURNAL

WITH WHICH IS INCORPORATED

THE IRON AND STEEL TRADES JOURNAL.

VOL. 34. Thursday, October 28, 1926. No. 532

PUBLISHED WEEKLY.

Subscription Terms: 15s per annum.
Foreign and Colonial, 17s. 6d. per annum.
All Subscriptions are payable in advance.

All communications to be addressed to the Editor, or to the Publisher, as the case may be, of

THE FOUNDRY TRADE JOURNAL,
49, WELLINGTON STREET, LONDON, W.C.2.
Telephone: Gerrard 3951 (4 lines).
Telegraphic Address: "Zacatecas, Rand, London."

Contents.

	PAGE
The Mutual Obligation of Foundrymen	361
Foundry Trestle	362
Current American Foundry Practice	363
Birmingham Metallurgical Society	366
Durable Moulds	367
Refractory Material and Slag Corrosion	368
Foundry Foreman	369
Wet Spots	370
The Obligation of the Ironfounder to Diesel Engine Users	371
Mechanical Sand Riddles	374
Discussion on Mr. Smith's Address on "Fifty Years of Foundry Progress"	375
Foundry Weighing Machines	377
Institute of British Foundrymen	377
Trade Talk	378
The Ductility of a Bronze Containing 20.0 per cent. of Tin	378
Iron and Steel Markets	380

Forthcoming Events.

OCTOBER 29.

Institution of Mechanical Engineers:—Informal meeting, in London. "Steel Castings in Mechanical Engineering." Paper by Robert Lowe.

Society of Technical Engineers:—Ordinary meeting, at Birmingham. "The Engineers' Bill," Paper by Richard Hazleton.

Institute of British Foundrymen.

NOVEMBER 3 and 4.

Joint meeting of Yorkshire and Derbyshire Branches at Sheffield.

NOVEMBER 6.

Lancashire Branch:—Ordinary meeting at Manchester. "The Manufacture and Properties of Blackheart Malleable Cast Iron," Paper by A. E. Pearce.

Birmingham, Coventry and West Midlands Branch:—Ordinary meeting at Birmingham. "Labour Conditions in American Foundries," Paper by J. T. Kay.

THE FOUNDRY TRADE JOURNAL IS THE OFFICIAL ORGAN OF THE INSTITUTE OF BRITISH FOUNDRYMEN; THE WELSH ENGINEERS' AND FOUNDERS' ASSOCIATION, AND THE FOUNDRY TRADES EQUIPMENT AND SUPPLIES ASSOCIATION.

Institute of British Foundrymen.
PRESIDENT, 1926-27: V. C. Faulkner,
49, Wellington Street, London, W.C.2.

LIST OF SECRETARIES—

General Secretary: W. G. Hollinworth, 38, Victoria Street, London, S.W.1.
Lancashire: T. Makemson, 21, Beresford Road, Gorse Hill, Stretford, Manchester.
Birmingham: F. K. Neath, 16, Sarehole Road, Hall Green, Birmingham.
Sheffield: R. Village, "Bircholme," Dronfield, near Sheffield.
Scottish: J. Bell, 60, St. Enoch Square, Glasgow.
London: H. G. Sommerfield, Charterhouse Chambers, Charterhouse Square, London, E.C.1.
Newcastle-on-Tyne: Colin Gresty, 101, Queen's Road, Monkseaton, Northumberland.
East Midlands: H. Bunting, 17, Marcus Street, Derby.
West Riding of Yorkshire Branch: S. W. Wise, 183, Moorside Road, Eccleshill, Bradford.
Wales and Monmouth Branch: J. J. McClelland, M.I.Mech.E., Druslyn, Bishops Road, Whitechurch, Glam.
Middlesbrough: N. D. Ridsdale, 3, Wilson Street, Middlesbrough.

Welsh Engineers' and Founders' Association.
Secretary: F. J. Griffiths, 20, Fisher Street, Swansea.

Foundry Trades Equipment & Supplies Association.
Secretary: K. S. Bridges, Avenue Chambers, Southampton Row, London, W.C.1.

The Mutual Obligation of Foundrymen.

After several excellent addresses on "What is Wrong with the Foundry Industry," an engineering society has also been favoured with a description of the poverty of the technical standard of British foundries. Whilst we appreciate that internal discussions can be productive of much good by instilling into the minds of those controlling it a better conception of the proper conduct of the foundry trade, we fail completely to see what good can come of washing dirty foundry linen before the eyes of the engineering public. It is based on an incomplete survey of the industry as a whole. In order to have a clearer conception of what the foundry industry is, one can make a comparison with the steel trade. This industry makes sections for constructional purposes, rails, tyres, axles, tool steels, and special steels, such as stainless, wortle plates and the like. Obviously, it would be a waste of time to ask a firm making high-speed steel to supply rails. It is exactly the same with the foundry industry, and people who expect a textile engineer's foundry to provide a chill roll will be disappointed. There is no need to worry about the allegation that several foundries have failed in the production of satisfactory Diesel engine castings so long as other foundries have been successful. Surely the business will gravitate towards the successful shops, and with their increased output, methods will be established which will place their product beyond the pale of criticism. After all, the manufacture of this type of casting can be compared with the high-speed steel section of the metallurgical industries; that is, it is a speciality not to be tackled by any foundry having a cupola of adequate capacity and an overhead crane capable of removing the finished casting. This depreciating of the technical standard achieved in British practice, undermines the confidence of the buyer, and induces in him a frame of mind receptive to the blandishments of the foreign salesman.

After studying carefully all that was said by both founders and engineers, one could not help feeling that there was a similar poverty of constructional ideas amongst the engineers as the founders. There was just the same arguing from the particular to the general which makes for mental atrophy. Because Germany has satisfied one particular user, then Britain cannot make good castings; or because some British castings have lasted nine years without exhibiting defects, then we are the premier country in the world for the production of high-grade castings.

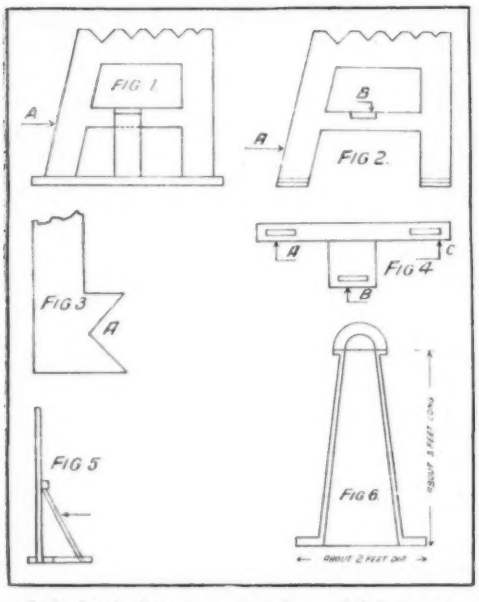
Surely the truth is that those foundries in any country that have married practice with science and know what they are doing, will command the cream of the work at their own price. We sincerely hope that when founders are addressing engineering audiences they will show them that where modern scientific control exists high-grade material can be regularly produced, and leave those founders struggling with the recipes culled from the grandfathers' notebooks to emulate successful practice, as sooner or later they must. Other methods merely cast a stigma on the whole trade, and put everybody concerned with it on the defensive—a mental attitude usually antipathetic to progress.

Foundry Trestle.

By J. E. P.

It is very remarkable that in these days of progress little, if any, attention is given to the consideration to the provision of efficient appliances for foundrymen for performing their daily task. This with special reference to trestles and stands.

Recently a visit was paid to an up-to-date foundry; although these works were very old, perhaps the oldest, advancement had been well maintained. There were excellent electrical travelling cranes, beautifully geared ladles, first-class sand-mixing plant, good drying stoves, a large quantity of reliable moulding boxes of all sizes, from 20 ft. by 12 ft. to 4 in. square, and a battery of good moulding machines, both hand and power, of various types. Cupolas and blowers were of the best, water laid on at various points in the foundry, easy access to the yard, and plenty of room for stacking mould boxes when out of use. The general organisation was good, yet when the core-making department was visited it was somewhat of a shock to the visitors, and a set-back for those who were hosts, to see such ramshackle, feeble, and broken-down trestles in use. One foot of one trestle was completely broken off,



and the leg had to be propped up with iron plates and packing, and, being of the ancient type, they had to be held in place by S hooks and weights, to prevent their falling over when cores were being trundled up upon them.

In other foundries visited conditions were even worse in this particular connection. Pieces of tubing were bent to something like the shape of the top of the sketch Fig. 1, then, following the outer contour of the frame of Fig. 1, and cast into pieces of iron for the feet. When these were put into use the least side or front strain would cause the whole lot—core and all else—to collapse. It was necessary to prop these trestles each side to ensure a moderate measure of safety before putting the core barrel upon them. It is quite a common practice to put 56-lb. weights upon the feet of these old trestles to prevent them tilting over at the front.

Fig. 1 is the sketch of a trestle which gave every satisfaction. The pair were made very easily in a few hours, all parts being cast in open sand moulds.

Fig. 2 shows the frame; it will be noticed that the front leg is extended a few inches at the bottom. This ensures perfect safety from being pulled over when the core is being trundled. B (Fig. 2) is a little toggle cast on the centre cross-bar to take the bearing of the half-leg. Fig. 3 shows enlarged sketch of the bottom of each outer leg; the double V piece A will, when cast into the foot plate (Fig. 4), enable the whole structure to be perfectly rigid and strong. The frame (Fig. 2) was cast first, then the half-leg A (Fig. 5). The foot plate (Fig. 4) was then moulded. Loam cakes or loam bricks were placed in the bottom of the mould at A, B, C, to carry the weight of the frame when it is placed in the mould of the foot plate for casting.

The frame and the half-leg was then placed in the proper position in the foot-plate mould, and held securely by means of cross-struts from the floor to the top of the frame, then the metal is poured round them in the foot mould, thus making a really good, sound, and serviceable trestle. The toggle B (Fig. 2) must be reversed to make the right-hand and left-hand trestle. This type of trestle will be found to be of great value to jobbing shops, where floor space is limited. In larger foundries, where floor space is not of such great moment, the fixed trestle is a very reliable method; the movable trestle is easily adjusted to requirements.

Fig. 6 shows the sketch of a very useful and substantial stand for propping parts of a mould up that cannot be turned over to be finished, or cannot be put into the stove for drying. As the moulders have to get under these parts and stay there for some hours, even longesr sometimes, every care and precaution should be taken to prevent accidents. Every moulder can tell of some accident happening through bad tackle, or careless or inexperienced rigging up of the class of work here mentioned.

It, therefore, behoves everybody concerned to play for safety every time. The trestles and stands shown in sketches are inexpensive, but very effective, and in actual working will be time-savers.

Book Reviews.

Engineering Factory Supplies, by W. J. Hiscox. Published by Sir Isaac Pitman & Sons, Limited, Parker Street, Kingsway, London, W.C.2. Price 5s. net.

If one desires to receive a true conception as to the importance of the stores in relation to the balance-sheet of any concern we would direct his attention to a firm engaged on the smelting of precious metals. It is somewhat amusing to find that auditors require a voucher for a cash expenditure of a few shillings, yet will pass "stocks on hand as certified by the departmental managers £30,000." Thus the question of stores in large works is of paramount importance, and whilst the author has dealt in an admirable way with his subject, we do feel that he should have dealt with the scientific provision of a figure for the financial balance-sheet. His method has been to deal with such factors as the material to be stocked; the scope of the buyer; facilities for storage; stores records, and the detection of errors. The author has much of interest for the foundry owner. He deals with pattern storage, the ordering of castings, and the stock-keeping of small stores, such as are required in every foundry. The book contains 171 pages, and is illustrated by 49 diagrams and charts.

Kelly's Directory of the Engineers, Iron, Metal, and Motor Trades, 1926. Published by Kelly's Directories, Ltd., 186, Strand, London, W.C.2. Price 45s. net, post free.

This directory covers the British Isles in its widest sense, and contains the names of those engaged in the actitivies covered by the title. No less than 60 per cent. of the entries have been changed in some manner since the last edition.

The scheme of the directory is to (1) give the names for each county, arranged under the towns and villages; (2) an alphabetical list of trades for the London Postal area; (3) a similar classification for the provinces; (4) an alphabetical list of branded articles and specialities for the engineering trades; (5) an alphabetical list of manufacturers of iron and steel sections; and (6) iron and steel manufacturers' brands. As a reliable directory for this class of business, the new edition can be thoroughly recommended.

According to official American statistics, their national sales of foundry supplies amounted to £21,544,000 in 1925.

We regret to announce the death of Mr. George K. Elliott, chief metallurgist of the Lunkenheimer Company, Cincinnati, and the author of the first American Exchange paper. A paper he had prepared dealing with the Frémont testing method was presented to the Detroit Convention. He died following an operation for appendicitis.

Current American Foundry Practice.

At the first meeting of the session of the Birmingham, Coventry and West Midlands Branch of the Institute of British Foundrymen, held at the Birmingham Engineers' Club on Thursday, October 14, Mr. J. E. Fletcher, M.I.Mech.E., gave an address on "Some Notes on Current American Foundry Practice." It was explained by the President (Mr. D. H. Wood) that Mr. Fletcher gave a Paper at the annual convention of the American Foundrymen's Association on behalf of the Institute, the value of which he hoped would be recognised by their organisation, and during his stay in the United States had many opportunities of visiting various foundries over a wide area.

Mr. Fletcher, after describing his travels and indicating the type of work done at different foundries, during which he mentioned that the Americans were extremely hospitable, said the manufacture of goods on a big scale coloured the visitor's vision wherever he went. So great a demand for commodities in a country with such a tremendous area and immense population was calling forth the product of the machine everywhere. The multifold copy of every article of common use was dispiacing the man, whilst at the same time requiring him in the production and upkeep of a never-ending mechanical development. Nowhere was the machine-made product more evident than in the foundries. The lay-out and equipment of the modern American foundry was usually exceedingly well-thought-out, great care being bestowed on the handling plants, cranes and transport facilities. A noticeable feature in automobile production was the number of specially designed moulding machines for dealing with deep draws and for picking out either horizontally or obliquely loose parts of the patterns for the avoidance of extra box parts or cores. In many directions, in such works there was to be seen the development of special moulding machines for individual patterns; machines of the costliest character, but economical because of the great number of castings required. Apart from these specialised types, the moulding plants were similar in type to those used for the same class of work in Britain. The sand-slinger machines were in common evidence in the larger foundries, and the sand-cutter and mixer was a great favourite. In some works, however, the older hydraulic squeezer machines were still used.

Drying Stoves.

The design and operation of drying stoves was receiving much attention, and continuous registration of temperatures on recording thermometers was the rule in many foundries. While British practice was not behind in their best foundries, speaking generally, the design of annealing and drying stoves left a good deal to be desired in both countries. Oil sand cores received critical attention, and both compressive and transverse tests were employed to keep the products uniform. The variety of bonding oils used was confusing, but the linseed oil type was common, the cheaper bonding materials of the cereal and pitch resin varieties were to be seen. This problem was being paid marked attention as regards research, but as regards large and heavy cores now being made in oil sand in the heavy foundries, it was recognised that the small test piece was not comparable with the heavy core. He had no hesitation in asserting that in several large British foundries the results of oil core-making were superior. Here, as in America, too many proprietary oils and mixtures were used, the nature of which was not thoroughly known by either seller or user. And, unfortunately, too little was known of the fundamentals affecting bonding strength and permeability, in the green and baked condition, as influenced by the sand condition as rammed or unrammed.

British Steel Castings Superior.

Sand blasting was general in many shops, but in neither small nor large casting foundries was the finish comparable to that in the best British works. In several foundries the sand preparation plants were excellent, and the tests of the AFA for cohesiveness, permeability and grain grading was a part of the foundry routine. In such works the removal of the old sand, its demagnetting and reconditioning, was carried out in a very practical manner, but as in this country there were too many foundries where the fettling was done either in or near the moulding shops. In the larger jobbing foundries American and British practice was much alike, with the notable exception that the more poorly bonded American moulding sands required much more care in venting and gagging: the moulding box top parts were a remarkable sight in some cases. Skin drying was not uncommon in green sand jobbing work, both in iron and steel foundries. A considerable amount of floor moulding occurred in some shops on typically British lines, whilst in others the same work was being moulded in boxes.

It was very evident that steel castings were rapidly displacing iron for large work. The finish and solidity of the castings left little to be desired in some foundries, but generally Britain had nothing to learn from the United States in this respect.

The use of the oxy-acetylene flame for the cutting off of risers and for surface defect welding-up was standard practice, though the electric arc was used in some works. No section of foundry practice needed more patience and courage on the part of the practical staff than the steel foundry, especially where large castings were made. The foundry never seemed to be big enough for its work, as in so many cases the demand for floor space might in one week be several times that of another, and jobs crowded one another out. The urgently-wanted breakdown job so often broke down a manager's well-arranged plan. He saw no departure in American steel foundries from the usual happenings in European works, and foundry managers there had the same intensive experience.

British Personel in American Foundries.

Speaking of the many Britishers whom he found employed in American foundries, Mr. Fletcher said the resourcefulness of Britishers, whether they were moulders or steel melters, was freely admitted, and their American cousins were glad to secure as many of them as they could. Wherever he went he found attention given to sand preparation in mass production foundries filled with moulding machines, but not the same in the jobbing shops. This was the case in some of the largest foundries. In too many cases the casting of steel ingots, rolls and sand-moulded castings, were carried out in the same shop, the removal of floor sand and the preparation of facing sand being tackled at such spots as were most convenient for the average demands of the moulders, introducing a very difficult problem. Both open hearth, Siemens', basic and acid melting furnaces were noticed, and also many electric furnaces of the Heroult, or modifications, from one to ten-ton capacity, were at work in foundries occupied with the smaller type of castings.

In Pennsylvania and Ohio natural gas was frequently used in open-hearth furnaces, but the change to producer gas and possibly oil and electrically-heated furnaces was coming, owing to the rapid diminution in the natural gas supply. While there was little that was fundamentally new in modern open hearth practice for steel casting service, in the larger furnaces for ingot production there was continuous progress in design in the direction of controlled mixtures of blast furnace and producer gas.

Refractories in American Practice.

The refractories problem occupied the same position as in Britain, the silica and silica-alumina type being predominant. A good deal of research work was being carried out in various institutions, and the investigations of the fire-brick makers—undoubtedly helped by the more theoretical work of the American Ceramic Society and the Bureau of Standards—was producing useful results, as was shown by the improving quality of the American

fire-bricks. The use of magnesite was extending, and some advance had been made as regards ladle stoppers and nozzles, for example. Cupola practice in the more modern works was good. In the best foundries the cupola proportions, blast conditions, etc., paralleled the best British practice. Schistose refractory rock material was being used in some quarters with success, but this development was still in the experimental stage. As might be expected, the mass production foundries used mechanically charged cupolas, the charging devices being of the well-known bucket and chute type in most cases. Their use was apparently confined to cupolas of more than 30-in. or 36-in. bore. Where large proportions of scrap were charged the results were better than when heavy lump scrap and pig-iron constituted the charges.

Mr. Fletcher proceeded to say that he understood with regard to mixer vessels that the development of the mixer method was in progress in the southern foundries on lines somewhat similar to those in Continental pipe works. As the sulphur trouble in American pig-iron was not generally serious, the suggestions of Nau and others did not appear to be making material headway. Pouring over the ladle lip was still the prevailing practice, even in the foundries occupied with the making of specially heavy castings. The difficulties experienced with running nozzles, and the erosive effect of high velocity metal streams on the runner gates and moulds, was cited by one foundryman who had tried bottom-run ladles. Some interesting experiments were in train at one works, on the determination of correct pouring speeds. This was along the lines pursued by earlier experimenters in Sheffield and German steel works and foundries. It was not sufficiently well known that the gospel of correct pouring speeds had been preached and practised in Sheffield for many years, and though the details have not been broadcast, several foundrymen of repute in Britain had systematised the pouring speeds for various classes of castings twenty years ago. As a result they had had great success in the securing of solid castings with smooth surfaces and freedom from skin defects. To the Americans, with their weaker moulding sands, the study of this problem must lead to an improvement in both their iron and steel castings.

Malleable Cast Iron.

The really classical work of Moldenke, Touceda and Schwartz in the development of blackheart malleable manufacture was one of the outstanding features of American foundry practice. In this connection Mr. Fletcher said he was greatly impressed by the layout of the plants, the design of the melting and annealing furnaces, and by the thoroughness of the methods used in the scientific control of moulding-sand mixtures, metal mixtures, and of the melting and annealing processes. He had the opportunity of seeing the most recent developments in melting practice, including those of firing by powdered fuel (coal) and underfeed stokers. The American air furnace had developed along lines rather different from British and Continental practice. The furnace with removable top was the recognised form, the fire-grate arrangements being suited to the type of fuel available, and the contour of the working chamber designed to meet the needs of the type of pig-iron and scrap charged. For melting both malleable and grey iron for high-quality castings and rolls the problem of furnace design had been tackled seriously, and the recent results obtained in respect to uniform metal composition, casting temperature, and fuel economy showed that great progress was being attained.

Labour Conditions.

Outstanding value attached to his visit, said Mr. Fletcher, because of the opportunities afforded him of studying the changes in practice forced by the differences in sand, fuel and pig-iron commercially available in the different districts, and in observing the various classes of labour engaged. A detailed description of this phase of the subject would take up too much time, but the methods employed must colour all his views of the foundry problem for a long time. The use of the machine in every possible direction had undoubtedly enabled the Americans to use this cosmopolitan crowd of different races and colour, and it was not difficult to see that progress there lay in this direction. The harnessing of this strange and motley team must tax the powers of American managers to the utmost, but it was being done successfully.

British Opportunities Increasing.

In the matter of skilled work in the jobbing industries, Mr. Fletcher concluded that it was becoming increasingly difficult in America to compete with Britain in the direction of high-quality productions, unless American managers could obtain sufficient skilled labour of the British type. The considerable sprinkling of British workers in American jobbing foundries, ironworks, and engineering establishments was a striking corollary to this idea. As regards the furnace plants, they were, as a rule, magnificent, from the point of view of output, regularity of product, and economical production. In the north the lower phosphorus iron produced from rich ores was generally high in total carbon content, a fact which was not unconnected with the use of semi-steel cast-iron mixtures in foundry practice. So long as the cost of ore and fuel transport was low, pig-iron costs as delivered to the nearest works would also be low. But the tendency of the iron and steel industry was to move westward, thus making pig-iron costs increasingly dear in the more eastern districts. This was already having its effect on the common iron industries near to the Atlantic seaboard. Then the high phosphorus pig-irons being produced in the southern States were costly to transport to the north, where they were indispensable to the light-castings trade. Distances of transport also applied to the best moulding sands. Hence the tendency to intensive production, whereby labour and establishment costs were lowered so as to counterbalance increasing costs of fuel, refractories, and pig-iron. As the centre of the iron and steel industries continued to move westward, the freight costs would make it increasingly difficult to compete with Europe for overseas trade.

Conclusions.

Mr. Fletcher then summed up his conclusions: (1) Mass-production methods were inevitable in America, where the demand for common articles was in immense numbers in standardised form. Hence big business concentrated on these products to the comparative exclusion of the "odd job" trade. (2) As Britain possessed a wealth of artizans in "odd job" production, the over-development of mass production, machine-made processes here might, if driven too far, result in damage to British craftsmanship. (3) Compared with America, our fuel, refractories, ore, pig-iron lay close to the doors of our foundry districts, and even foreign ores could be shipped here cheaply. Hence, if unfair Continental competition could be eliminated, there should be no fear of American competition in the ferrous industries; always provided that improved methods were followed, that foundries kept pace with applied developments of scientific research, and by reasonable methods they increased the number of skilled craftsmen in their works and laboratories; so that, whilst steadily developing a mass production trade, the special individualistic character of the British race might be used in creating an increased demand for the high quality products for which our nation had always stood.

DISCUSSION.

The President, inviting discussion, mentioned that Mr. Fletcher was consultant to the British Cast Iron Association and also to the Wrought Iron Association, and added from what he had told them of American iron and steel castings they might still utilise the slogan, "British Goods are Best."

Poorly Finished Castings.

Mr. F. J. Cook, who also attended one American conference, said he was interested to see as many jobbing foundries as possible, and not the big foundries. At one place he was shown a foundry, where everything in the way of chilled moulds, etc., were made for the glass houses, which was

extremely well organised. But he was struck with the absence of scientific working, just as they would be in many of the Black Country foundries. These foundries obtained certain mixtures and secured quite decent results, however. The Westinghouse foundries were very fine. At one of their places castings were not made of more than ½ cwt., and he could not tell how many trainloads went out daily. In this country they had no conception of the continuity of work in the United States. At one foundry a pattern would not be looked at unless 2,000 of it were taken, and even then it would be refused unless it was a repetition order. Thus men who were unskilled became skilled on a particular job, and the heads of businesses could afford with so large an output to spend an enormous amount of time on the pattern plate and make it absolutely fool-proof. As to the general finish of castings, he agreed that there was nothing that they saw from which they in this country had anything to fear, even in the best American work, while compared with the worst they in Britain had a great deal on which to pride themselves. When they came to the big floor work, particularly in some of the machine tool foundries, it left a great deal to be desired. In many American foundries almost anything that would serve was considered good enough for the job. Thus, while in the States this want of quality was carried too far, here they had a tendency in the opposite direction. The mechanical charging plant for cupolas was remarkably good. There were very large cupola plants there, 25 tons an hour being not uncommon. The mechanical method was, of course, the only way of obtaining regularity in these big plants. He noticed a more general use of blast volume gauges. In the past there had been some lack of knowledge in pressure gauges, but they had now got down to watching cupola practice more. Mr. Fletcher was giving of his best in cast iron research towards standardising cupola practice, and the use and study of blast pressure gauges would be a considerable help in this direction.

Skilled Moulders and Real Wages.

Mr. E. J. Lewis, as one interested in foreign trade, agreed that they had nothing to fear from American competition, because although American foundries turned out castings much faster than was the case here, the freight problem was killing American export trade. But they must realise that American foundries were robbing them of their best labour. No English moulder would be refused a job in the United States. They should certainly make an effort to retain the skilled artizans who were now attracted overseas. Subject to the cost of living, he thought they could afford to approximate to the rate of wages in America. Notwithstanding the boosting given about American wages, it should be pointed out that an English penny was equivalent to 5d. out there. There was not always the large difference there was supposed to be between the wages paid in America and Britain to their best moulders.

Competition from Drop Forgings.

Mr. Callaghan, referring to drop forgings, asked what competition were they experiencing in this country against small castings? He understood that the Westinghouse or Mester machine plant was turning out a quantity of iron forgings. During the past month or so he had quoted low figures for small castings, and was cut out by a wide margin, he believed, by drop forgings coming from the United States. Did black labour enable the American foundries to produce cheaper by reason of a smaller wage rate. He gathered that black labour was employed a good deal on machine work, and the coloured labour might, of course, be able to stand the heat better. The speaker quoted the figure of 75 per cent. which had been given as representing Europeans being employed on the best jobs, and said he understood that they were chiefly British. Asking were there any apprentices in America, Mr. Callaghan said he believed the American foundries depended on obtaining skilled artizans from this country.

Mr. Fletcher, in reply, said he did not know that drop forgings were cutting out castings, provided they were of the same weight. In many cases, of course, drop forgings as against iron castings could be made half the weight. This made a big difference straightaway, for if they could obtain a drop forging of 2 cwt. or so to replace a casting of about 5 cwt. they could afford to pay the difference in the cost of the drop forging. This replacement of castings was one of the things they had to fight against in this country. In some cases it depended upon the market; with pig-iron and scrap low, the cost of castings was low, and they could beat drop forgings, but in less favourable circumstances drop forgings beat castings. (Mr. Cook interposed that the plant at the Mester works did not strike him as being in advance of drop forging plant here.) Mr. Fletcher said his firm made hundreds of thousands of small studs for chains, and for the purpose put in some drop forging machine plant, because the cost of the castings was only half that of drop forgings. There was some difficulty in the process of drop forging; it was not an easy thing to do. It was not a question that one could readily be dogmatic about because of the differences referred to, especially with regard to that of weight. As regards coloured labour, he was informed that wages were the same all round for machine work, and they did not find many men away from the machines. At Ford's foundries coloured labour was employed in charging the cupolas. A whole regiment of them was engaged for this purpose, and the manager told him that there was no comparison between mechanical charging and the method he employed in the product, and in the regularity of charging in that area, which was concerned with fairly light scrap for the automobile foundries. The men were earning quite good wages, which were comparable with those paid to others, and were able to spread the scrap on top of the coke. Class distinctions passed when the workers got inside the factory, and these distinctions were nothing like so severe as they might imagine except in a few centres. No system of apprenticeship had been adopted, although an American professor had been trying hard to secure some measure of training on this basis. This, he thought, would make a considerable difference to American trade. He was told that in a particular area the foundries could take every moulder Great Britain had got. At home they regarded a shop with 50 or 60 moulders as one of considerable size, but when they saw a thousand working at one place it was a little staggering.

Americans Work Harder.

Mr. Tyson remarked that he saw men working harder in American foundries than ever he had noticed in this country. In America they were out for the money, which was the reason why they obtained big production. At the same time, there was an enormous amount of welding of castings which they in England would throw on the scrap heap. At one shop turning out cylinders he thought there was hardly a casting but was subject to welding.

Clean Floors a Fetish.

Mr. Fletcher replied that handling in jobbing foundries depended on whether it was a large shop or not. The large shops, like those here, were served by a crane running from end to end, with a small one underneath. For side shops the crane ran in opposite directions. In few American shops did they see any bogey running; it was nearly all overhead work. Foundry managers there had a mania for clear floors, and were certainly right in this attitude. In some of the older shops, however, trams were to be seen. The walking or jib crane was frequently employed. American sands were very short of bond. The grains in their English sand were covered by a jacket of clay, forming an automatic bonding material which required little milling to make it efficient. It had to be milled to get the clay off the grains, so that when ramming took place and moisture was added, the necessary adhesion was secured. In America the sands differed, being largely of smooth quartz grain, possessing little bonding material. Hence fireclay had to be added to the clean sands, and in many districts there was nothing else available. Bonding sands were so far away that the cost of freightage was equivalent to 30s. a ton. Mr. Harrington, whom he hoped

would come over here next year, told him he had experienced so much trouble with sand, and he was not so far away from the best beds in Albany, that he had been compelled to specify that all his sands should be passed through a quarter mesh riddle. It made a considerable difference to his costs, and of course to the quality of his castings; and if they in this country could buy sand under such conditions it would undoubtedly be a good thing for them. If the sand pit people were a little more careful in sorting they would not find big lumps which on grinding turned out to be building sand; but often they did not discover that something was wrong until the casting had been made. This was a common trouble in American foundries. Consequently over there they had been forced into sand research in order to find sands which would work properly, especially in deep jobs and moulding machine work, as the sand would not stand up. Mr. Harrington said he had not found a machine which would deal with particular jobs because he could not get the right mixture to bond itself. Therefore he had been driven to use oil mixtures, because of failure to obtain clay bonding material. This problem of sand bonding was going to be still more costly in America, and it would have an effect on competition so far as castings were concerned. There was no sand in the world equal to that which lay within twenty miles of Birmingham, which was of immense advantage to them in the Midlands.

Mr. Starr moved a vote of thanks to Mr. Fletcher, which Mr. Roe seconded. The latter stated that some years ago he saw in the Ford foundry a multiple moulding machine which did four operations in series and had an output of 2,000 to 2,500 boxes per day. It had an automatic feed, and the men working it seemed to have a soft job. Works' instructions were in no fewer than 40 languages, so he imagined there would be some difficulty in ordering and supervising a cosmopolitan class of labour such as the big works engaged. The vote was carried.

Catalogues Received.

Boilers.—Catalogue HI, of which we have received an advance copy from Messrs. James Keith & Blackman Company, Limited, of 27, Farringdon Avenue, London, E.C.4, is uniform with the major portion of their publications, and describes and illustrates the "Challenge" and "Junior Challenge" types of boilers. For heating shops and offices, they present many excellent features, and for foundrymen likely to study this phase, we understand, copies are available.

High-temperature Furnaces for Heat-treatment.—Section K, recently published by Automatic & Electric Furnaces, 173, Farringdon Road, London, E.C.1, is devoted to subjects of high-speed steel-hardening furnaces. Some very practical hints based on the poor elasticity of high-speed steel are given. The furnace described is electrically heated, and is provided with a preheating chamber and a very conveniently situated tray. The preheating chamber, situated directly below the main hardening chamber, reaches a temperature of 850 deg. C., whilst the actual hardening chamber can be controlled at 1,350 deg. C. A single-unit furnace is made, and can be used with every assurance of success where thin-sectioned material is heat-treated. Tempering muffles, too, are described and illustrated.

Power Transmission.—In common with many other firms, Messrs. Crofts, Limited, of Bradford, have succumbed to the multiple-folder phase of publicity. It is a type for which we do not care, as we feel that in general they are meant to catch the eye, whilst our conception is that it is a better plan to ensure a permanent place in the bookshelf of the buyer.

With this folder were enclosed two single folders, one dealing with belt-tension devices and the other back gears. These we consider to be good examples of publicity. The multiple folder draws attention to plummer blocks and pulleys, all having ball bearings. All such sheets, to our mind, should invite the recipient to apply for the standard catalogue, the which we are aware in this case reaches a very high standard of excellence.

Birmingham Metallurgical Society.

In his Presidential Address to the Birmingham Metallurgical Society, at a meeting held at the Engineers' Club, Waterloo Street, Birmingham, on Thursday last, Mr. E. M. Boote stated that the Society is on the eve of a new departure, and is commencing an experiment in the co-ordination of some of the activities of this Society with those of two other technical societies in the district, which have similar aims and interests.

He referred to the programme of meetings arranged by the Co-ordinating Committee, representing the Staffordshire Iron and Steel Institute, the Birmingham Metallurgical Society, and the Birmingham Local Section of the Institute of Metals. If, in years to come, he stated, this should prove to be a "far-reaching and beneficial measure," as he and they all sincerely hoped that it would, then he should feel that his term of office had been a successful one, apart from any other consideration.

He discussed at length the aims and ideals of this movement, and stated they had an excellent precedent in co-operating of the work of various other societies, notably amongst the engineers, and especially in America, whose aim was not the merging of the separate or smaller societies, with consequent loss of individual identity, which would be distasteful to any organised body with life in it, but rather a true federation of service and interests. He then gave a detailed history of each of the component societies, from its inception, passing on to the formation, recently, of the Co-ordination Committee, which has undertaken the production of a programme of meetings and social functions common to all the societies comprising the movement, but any form of amalgamation or interference with the identity, character, or administration of these societies was not considered desirable, whereas a closer co-operation or pooling of certain interests common to all showed distinct advantages.

The President thought that each member of the three societies would receive more by this scheme than had hitherto been the case, and that it tended towards the advance of metallurgical knowledge.

Mr. Boote proceeded to give a brief historical sketch of the progress of metallurgical knowledge from early times, stating that whilst the practice of metallurgy had been pursued from the remotest ages, the literature on the subject was very scanty, and very little of it written before 60 or 70 years ago would be of service to the student of to-day.

During recent years, however, the stream of knowledge had spread like a torrent, for there are to-day literally tens of thousands of skilled workers devoting their whole attention to scientific and practical metallurgy. The future march of industry, and possibly of civilisation, depended to a large extent on the scientific understanding and skilful handling of metals.

The speaker stated that he could not help feeling that there was still greater scope for research in some of the aluminium alloys, iridium, and the platinum group, tungsten, and the more complicated alloy-steels, the functions of some of the rarer component metals of the latter being little understood. He included also the carbon-free iron-nickel alloys in this summary.

Manganese Ore Cargoes through the Suez Canal.—During last year 840,000 tons of manganese ore passed through the Suez Canal into the Mediterranean (as compared with 886,000 in 1924 and 984,000 tons in 1923). Of this tonnage 746,000 (769,000) tons came from the East Indies, 82,000 (106,000) tons from countries on the Red Sea coast, and 12,000 (11,000) tons from other countries. For India the record year was 1923, during which the ore shipments totalled 869,000 tons, of which 394,000 tons came from ports on the East Coast, principally from Calcutta, while those from the West Coast were principally from Bombay (378,000 tons); Karrachee only shipped 8,000 tons, and Mormugao in Portuguese territory and the other West Coast ports 89,000 tons. In 1925 the shipments from Bombay were only 300,000 tons, and showed a decrease compared with 1923, while Karrachee with 12,000 tons showed a small increase and Mormugao and the other ports a substantial increase with 136,000 tons.

Durable Moulds.*

By James A. Murphy, Hamilton, Ohio.

Like the transmutation of metals, the permanent mould has been sought for ages by foundrymen of every clime, but with only very indifferent success. In recent years the necessary capital has been put behind the project of development and the successes achieved give much promise for certain classes of castings. However, the processes and methods employed have limitations, and will always have some, even should most of the unfavourable physical and mechanical features, as are now known, be eliminated. The development of faster and better moulding machinery and other appliances for the more rapid production of castings in the sand mould is likely to make both the first and ultimate cost of a permanent mould a great factor against it. The superiority of castings from the iron mould is unquestioned for many uses, but as their first cost is greater, and is likely to remain so for some time, difficulty is and will be found in selling the product at an excess price over that of sand castings.

The semi-permanent or durable mould, as the author prefers to call it, has a different field altogether. It is seldom applicable to small or medium work and is not advocated where the moulding machine can be profitably applied. It has been found advantageous only on such large work as is made in quantities large enough to justify the added expense of construction. It has limitations, too, for the configuration of the casting must be such that it can be removed from the mould or the mould removed from it without a complete breaking up in the process. Much ingenuity can often be employed to prevent this, and projection can be made on cores which are in turn inserted in iron slip jackets, but as each job is a law unto itself, it must be left to the individual judgment of the foundryman immediately concerned. The two jobs shown are only examples of what is and can be done along this line.

The writer has made a great many durable moulds, some for a few castings and some for hundreds. Where only a few castings were required we did not go to much expense, using only an extra plate and a few bolts, or something of that kind. For the larger castings a fire-brick mould was frequently made, properly bolted and secured together, so that copes could be turned over and the whole mould placed in storage for future use, if desired.

Figs. 1 and 2 show a plan and a section of a segment of a plate glass table, 36 ft. dia., each section weighing about 8 tons.

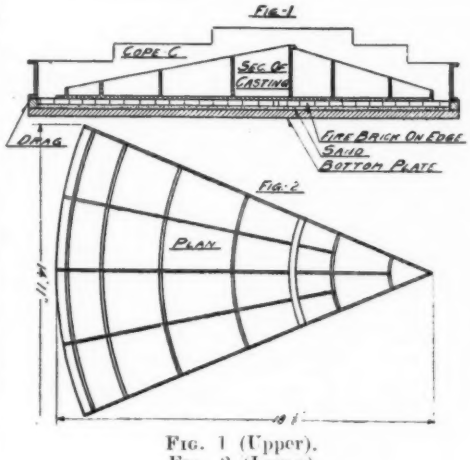


FIG. 1 (Upper).
FIG. 2 (Lower).

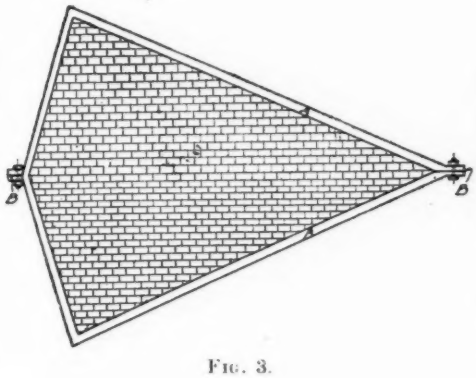


FIG. 3.

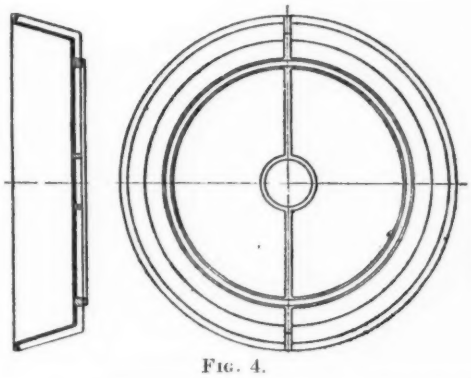


FIG. 4.

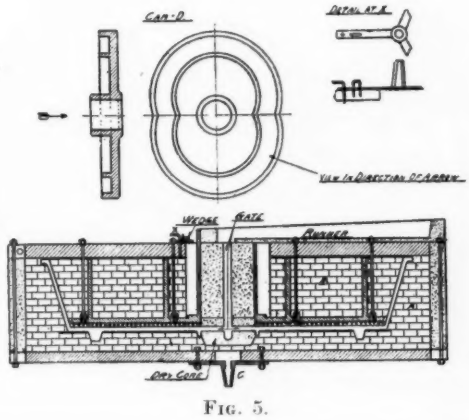


FIG. 5.

Fig. 3 shows the drag or permanent face of the mould. The firebricks are laid close together on edge. They are laid on a sand cushion or bed, and no mortar is used between them. After being laid the bed is heavily coated with clay wash and the face of the mould given a coat of ordinary blacking. No loam is used, the metal being poured on the naked bricks. The outline of the bricks can easily be discerned on the face of the casting, but as it is finished in the rough, this is no drawback. Indeed, the slight chilling effect of the brick is a distinct advantage, as the face presents a beautifully clear and close surface when finished. The cope is rammed by hand in green sand and is so arranged by the use of slab lifting cores that not a single gagger is necessary. The mould has been in use for 18 years, and probably over 1,000 castings have been made in it.

Fig. 4 is a plan and elevation of a gas-producer pan made in halves approximately 14 ft. dia., 2 ft. deep and $\frac{7}{8}$ in. thick.

* A Paper read before the Detroit meeting of the American Foundrymen's Association.

Fig. 5 is a section of the mould, shown in such detail that only a short description is necessary: (*a*) is the drag which remains permanently on the floor, surrounded by a curbing; (*b*) is the cope which is lifted off after the casting is sufficiently cool. Before lifting off, a spindle seat similar to (*c*) is bolted on the top in the reverse position, it being properly dowelled for accurate location. When the cope is rolled over a keyed spindle carrying the cam is placed in the seat. This cam serves the purpose of separating the two halves of the casting by 4 in., so that a splitting cope is provided. The casting is by this means swept up as though it were a plain round one, the moulder paying no attention to the slightly elliptical shape. The sweep arm is in two parts, the one sliding on the other. The face of this mould is firebrick and a light coat of loam is used each time the mould is used. While the mould is in use nearly enough heat is in it to dry itself. When the cope is finished the spindle carrying the cam (*d*) is set in the step (*c*) and the drag part finished in the usual way. Over 100 castings were made in this mould, one man casting one every two days. The weight of the casting is about 5 tons.

Moulds in two, three or more parts could be made from ceramic mixtures, such as is suitable for firebricks, being burned and treated the same as firebricks. The contour of the casting, however, must lend itself to such treatment and then it must be made in sufficient quantities, without change, to warrant the initial expenditure.

Refractory Material and Slag Corrosion.

The Report of the Refractory Materials Joint Committee, submitted at the London meeting of the Institution of Gas Engineers, contains a Paper on "The Testing of Refractory Material for Resistance to Slag Corrosion and Erosion," by Mr. A. Dale, B.Sc., who points out that a very appreciable item in production costs in the metallurgical, glass, carbonising, and other industries utilising high temperatures may be traced to the deleterious interaction of refractories and molten slags. The solvent and erosive effect of slags on refractory materials is responsible for unsatisfactory service of furnace structures in more ways than one. For example, in the open-hearth steel furnace there occurs a continued dissolution of the inner faces of the walls below and above the slag levels; excessive corrosion, erosion and fluxing of the roof are caused by the constant impact of innumerable fluid particles carried along by the heating gases; a similar phenomenon quickly alters the contour of the ports or bulkheads.

In the regenerators, foreign matter carried by the gases impinges on the chequerwork, and continued surface action proceeds. Either the face of the chequers is continually dissolved in the downward trickle of a corrosive slag, or an adherent layer gradually develops; in both cases, the life or efficiency of the regenerative system is adversely affected. In the coal-fired boiler furnace, when certain types of coal are employed, highly viscous clinker-formation develops on the side walls. This reduces grate area, and hence general working efficiency; in addition, its removal is frequently accompanied by the dislodgment of a considerable amount of the refractory lining. Excessive attack of ash on brickwork frequently occurs in producer gas and water-gas installations. In certain types of heat treatment or reheating furnaces, quantities of metal scale become deposited on the hearth. In the case of iron oxide and when the prevalent atmosphere possesses a certain concentration of reducing gases, an undesirable fluxing and disintegration of the hearth structural material takes place. Apart from this effect, contamination of the heated billets of the fluid or sticky product of interaction is likely to cause trouble during the subsequent processes of manufacture.

These specific examples have been quoted in illustration of the diversity of ways in which slag-brick interactions are able materially to enhance production costs. In general, it may be asserted that the solvent or erosive effect of molten slags, either in bulk or in the fine forms carried by gases moving at high velocity, is responsible for the short service of refractory material in numerous types of industrial use. This being so, the varied aspects of the general problem would appear to present a worthy field for experimental investigation.

Generally speaking, an elimination or lessening of the deleterious slagging actions may possibly be effected by application of the following procedures:—(*a*) By structural modifications, elaborations, and by temperature control; (*b*) by control of the chemical, mineralogical and physical constitution and nature of the refractory materials.

It is outside the theme of this Paper to consider in any detail the possible devices, which may be included under (*a*) above, and which promise well from the economic viewpoint. Brief mention should, however, be made of the advantages which may attend the readjustment of internal furnace contour; elimination of fuel or other dust from the heating gases by mechanical or electrical precipitation; application of special air or water cooling, with the object of reducing hot face temperature of refractory linings; the conservative use of thermal insulation; control and limitation of working temperatures below the prescribed maxima; and control of slag composition.

The main aim of the present report is rather to recount what has already been achieved by previous workers in field (*b*) above, and to suggest the scheme of attack in this direction, which the British Refractories Research Association expect to be able to develop in the near future. This the author does in some detail. In his concluding remarks he says that, generally speaking, it may be stated that the corrodibility of a given brick by a given slag under special industrial conditions is governed by numerous influencing factors. Amongst these may be mentioned the chemical and mineralogical constitution of the brick, and also its penetrability; the cohesion between grog and matrix, and the degree of internal strain; the nature, constitution, etc., of the slag, the prevailing temperature and atmosphere, temperature irregularities and temperature gradients through the refractory material; the internal contour of the furnace or flue, in so far as this controls or restricts density and convection movements in the melt; the structural stresses encountered; the type of jointing and jointing materials used. Many of these factors are, however, of a purely industrial nature, and may be regarded as accelerating the fundamental phenomena—rate of solution and erosion per unit area of slag brick contact.

This suggests that laboratory methods of investigation, which would evaluate the progressive rate of corrosion and erosion of different bricks by different slags at three or four different high temperatures, should provide results of fundamental significance, and hence of definite industrial value. It is along these lines that the Association hopes to develop further the work recounted in the Paper.

Ford's Five-Day Week.—Considerable attention has been attracted in the United States by the announcement of Henry Ford that the working week of all his employees has been reduced to five days. It is recalled with interest that in iron and steel plants in America in 1923 the proportion of those working 43 hours or less was 34.8 per cent.; those working 48 to 54 hours constituted 26.4 per cent., and those working 54 hours or more per week made up 38.8 per cent. of the total. The industry in that year began to abolish the 12-hour shift, but the effect was not fully reflected in the Census Report. In foundries and machine shops in the United States 29.9 per cent. of the workers in 1923 were on schedules of 48 hours or less per week; 47.2 per cent. were working 48 to 54 hours per week, and only 22.9 per cent. were working over 54 hours. The Census showed that in the motor-car industry 41 per cent. of the employees were on a weekly basis of 48 hours or less; 49.5 per cent. on 48 to 54 hours, and 9.57 per cent. were working more than 54 hours per week. If Mr. Ford pays as much for five days' work as he formerly paid for six, the effect would be similar to increasing wages by 16 per cent. That this is intended, however, is not clear from the latest mail reports, which ascribe to him the statement, "We are now working out the wage schedules."

Foundry Foremen.

The first meeting of the Scottish Branch of the Institute of British Foundrymen for the Winter Session was held in the Technical College, Glasgow, on Saturday, October 16. Mr. Affleck, President for the previous year, occupied the chair, and commented on the encouraging attendance. Mr. Alex. S. Mearns, of Glasgow, was installed president for the coming year. A vote of thanks was accorded to Mr. Affleck for his services as president during the past two years.

Mr. Mearns, in his presidential address, dealt with the status of the foundrymen, with particular reference to foremen. By the foundrymen he meant all those upon whom the success of the foundry depended—the draughtsman, pattern-maker, moulder, and others.

The Ideal Foundry.

The duties allocated to the foundry foremen, he said, varied very greatly in different foundries. There was the ideal foundry, where all plant was up to date, and where a practical and sympathetic manager saw to it that everything necessary to achieve good results was provided. In such a foundry the foundry foreman was the connecting link between the drawing-office and the pattern-shop, to both of which he should have ready access. He feared, however, that there were few such shops in existence. Many foundries were not connected with the shipbuilding or engineering shops where plans and patterns were prepared, and the foundry foreman in such cases was deprived of the opportunity for consultation with draughtsmen and patternmakers, which was so valuable. So long as many of our great shipbuilding firms declined to run their own foundries, and continued to rely upon sub-contracting for this part of their work, this drawback would remain.

Overtaxed Foundries.

Very many foundries, unfortunately, suffered the further disadvantage of lacking up-to-date plant. It was recognised, of course, that the installing of every new improvement into every foundry was impracticable. Yet there were foundries where totally inadequate provision was made for the proper conduct of the business; where plant was insufficient and antiquated. In many cases such foundries undertook jobs far beyond the capacity of their plant to handle, and attempts were made to do jobs with tackle quite unsuited to the purpose. In a shop like this, exceptional care and consideration were necessary on the part of the foundry foreman. He was required to bring all his ingenuity to bear to use what plant he had to the best advantage, and must be for ever on the alert to prevent disaster. Indeed, he must be at times ready to depart altogether from orthodox methods.

Other foundries again suffered from the fact that supervision was in the hands of a non-practical manager. He had always felt that this was a very grave disadvantage, and one for which he had seldom seen any necessity. The common excuse given for such a state of affairs was the necessity for having a capable organiser superintending the work, but he did not think that was an adequate reason. There were many men available who were not only practical foundrymen, but who had the necessary organising ability in addition. The lack of a practical manager was apt to dispel that mutual confidence and sympathy that ought to exist between manager and foreman, and deprived the forman of consultation to which he was really entitled. A non-practical manager was unable to take his share of the responsibility for important decisions which had frequently to be made, and the lack of a practical manager was frequently the real cause for the absence of proper plant and material. The non-practical manager did not appreciate to the full what the lack of proper plant and material meant, and was not able, therefore, to understand the failures which must occur in every foundry.

In his view, continued Mr. Mearns, the place of the foundry, even in the general engineering establishment, was not fully appreciated, and he thought it would be to the advantage of the whole works if its importance was properly understood. There was no branch of the engineering trade which called more earnestly than the foundry for a combination of technical and practical knowledge of materials and their working. Such qualifications could alone equip the men who must estimate for work, time all jobs, and carry out the work of the foundry on efficient and economical lines.

This was becoming more and more apparent. To-day jobs much more complicated in design than any job undertaken in the past were being undertaken. Castings were made to stand pressure tests formerly undreamt of, and in every department an accuracy and uniformity of thickness of metal formerly not expected was now insisted upon. In one recent case, a casting to a specification providing for a satisfactory test up to 300 lbs. per sq. in. was actually tested up to 400 lbs., but was rejected because on one side the metal was $\frac{1}{16}$ th of an in. below, and on the other, $\frac{1}{16}$ th of an in. above the draughtsman's sizes. All this cast additional responsibility on the foundry foreman and rendered his task more oppressive and anxious.

If the foreman was to give of his best, the removal of these disadvantages was the surest course. If his time was taken up in circumventing and anticipating difficulties, he was bound to be worried, and was not getting a proper chance to see to his legitimate duties.

Necessary Qualifications.

There were some qualifications of the ideal foundry foreman to which he would refer. The first was, of course, a sound grounding in the various branches of the trade. Without this foundation the most capable man started at a disadvantage. But building on that foundation he will add an ability for organising, an equable temperament, a desire to know his men, and a recognition that all the knowledge of the trade does not rest in him, and that even an apprentice may make a suggestion worthy of consideration. Attention to detail was very important, and before the commencement of any job, time would be well spent in considering the best method of tackling it. Having done so, the foreman was in a position to issue instructions as to the gating, feeding, easing, camber, etc., and he will arrange with the coremaker as to where vents in the cores are required and how they are to be led off. He will instruct as to the necessary lifters and their placing and will take necessary steps to see that when the job is closed there will be no misunderstanding between the moulder and the coremaker. The closing accomplished, the making up of the head called for great care; its importance could not be overestimated, yet very many moulders did not seem to appreciate the importance of this operation, and seemed to think that anything would do, so long as there was a path for the metal. They appear to overlook the fact that if the head is not properly made, air and slag might quite easily get into the mould and thus lead to a waster casting. This was particularly the case to-day, when inferior material was often used. The weighting and binding of the mould also called for care.

Foremen as Buyers.

Then there was the all-important question of the metal. Different jobs called for different classes of iron, and it is here that the foreman often finds his greatest difficulty. Here his hands were often tied, for the buying or selection of the metal was not his duty. This was often in the hands of someone who lacked the practical training necessary to proper discrimination. It frequently happened, therefore, that the foreman was obliged to use metal which he knew was not really suitable for the job in hand. The question of cost had been the one thing considered by the buyer, and now the risk of a much heavier loss than any difference in the price of material rested on the shoulders of the foreman. The buying of iron was one of those things which frequently led to confusion and trouble in the foundry; it might look clean and of good quality, but might have many other defects for foundry purposes.

The same thing applied to coke. There was almost no limit to the difficulties that might con-

XUM

front the foundry foreman as the result of saving a few shillings a ton on coke or iron. The buying of materials was so important that, in his opinion, it should be carried out invariably by someone having not only a good technical knowledge but combined with it a sound practical experience of the materials required.

Economies by Co-operation.

It had always seemed to him that much advantage would follow if the foundry foreman was consulted by the foreman pattern-maker and allowed to co-operate with him before the patterns were made. There was no doubt that such consultation would in many cases lead to the preparation of cheaper patterns and in other cases to patterns which might cost slightly more, but which would lead to saving in the moulding shop. It was, in his view, an untenable position in a good shop that the pattern-shop and the foundry should be in watertight compartments as so many of them were. There were, of course, many firms who steadily declined to permit the foundry foreman to have any insight into the dissection costs of jobs. Of course it might be desirable that certain information of this kind should be retained by the counting-house alone, but the secrecy maintained in most cases was, in his view, unnecessary. He thought it would be to the advantage of the whole work if statements were circulated from the counting-house showing the percentage costs of various operations. It would in this way be possible to foster a spirit of emulation among the various departments and might lead to considerable economy in overhead costs.

He thought they would all agree with him, therefore, that the position of foundry foremen demanded qualities of a high order and qualities that called for confidence on the part of employers. He had always thought that it would be in the interests of all if such confidence were shown to a greater extent. This raised the question as to whether the importance of the foreman's duties was properly appreciated. He thought that it was not fully recognised. There was not a proper realisation of what the foreman might do, but, financially, he was, as a rule, inadequately rewarded. This again was false economy. If journeymen moulders and even non-skilled men supervised by the foreman were able, as they often were, to earn wages in excess of the foreman's wage, there was little inducement for a man to prepare himself for the position of foreman. In this connection much might be done by the formation of a junior section of the Institute, and he hoped to see such a section shortly in being. Working hand in hand with the foreman, a junior section might do much in the education of apprentices and inculcating of that general knowledge which was so often lacking and which might raise the level of the craft to that position which they would all like to see it occupy.

A Paper on the "Principles and Practice of Gating, Feeding and Venting" was read by Mr. Davis, Whiteinch, second prize-winner of the Surtees Competition, and the meeting was thereafter thrown open to discussion.

Publication Received.

Aluminium Foundry Practice. Published by the British Aluminium Company, Adelaide House, King William Street, London, E.C.4.

The only adverse criticism we have to make for this book is that it is free, and very often when people get something for nothing it is not appreciated. Mr. George Mortimer is responsible for the matter, most of which has previously been published in this journal, much of it exclusively. From the practical point of view, we know of no better work to consult, and we congratulate all those concerned in its compilation. The book takes the subject right from the inherent properties of aluminium through alloy preparation, melting, moulding, feeding to die castings. It contains 91 pages and 42 illustrations, many of the latter being of the greatest practical utility. Readers securing a copy can count themselves as being very fortunate.

Wet Spots.

By J. H. List.

During a day's tour through the works one passes on to the hydraulic testing bay and sees a casting marked with a white ring. On making inquiries from the tester one learns that this casting did not withstand the necessary test and consequently had been rejected. On making further inquiries one is informed that the cause of the rejection is on account of a cold lap indicated by the white ring. Such inquiries may have been put by a practical foundryman, who on closer examination finds that what the tester denotes as a cold lap is that part which formed the bottom half of the mould.

How often does this sort of thing occur? The casting under review has been rejected on account apparently of a cold lap. As is well known cold laps do not often occur in such places, if ever. The question then arises, if not a cold lap what is the fault? The fault may certainly resemble the appearance of a cold lap. The writer has had similar experiences; the object of this article is to help to correct this mistaken idea. The fault is certainly not a cold lap. A cold lap is the direct result of (1) cold metal; (2) insufficient runners; (3) badly placed runners and gates, and (4) poor facings. A true cold lap appears in the top half of the casting and occurs where the incoming metal fails properly to unite with the general mass. The fault under review is caused by *wet spots*. If such a casting were broken up, and the part forming the fault was put under a microscope and chemically analysed, the surface of the cavity would be found to be covered with hydrated oxide of iron, and would penetrate into the casting for a short distance.

What has very probably taken place is that the mould has had a wet spot of sand near the bottom of the mould and in close proximity to the position of the fault on the casting. This amount of dampness, although not sufficient to cause an obvious blow, would be sufficient to cause more rapid cooling of the iron in that area, resulting in the trapping of the steam.

The oxygen in the water would have combined with the iron forming hydrated oxide. The lesson to be learnt is, one must realise there is a difference between a cold lap and a wet spot. This difference is considerable and bears no relation to the other. It is easy to send a report into the foundry stating a cold lap, and it is just as easy for the foundry to overcome that difficulty, but the fact of saying it is a cold lap when it is a wet spot will make matters worse, and will not decrease that source of wasters.

The cure for wet spots is to dry or to skin-dry the moulds. If, however, this is too expensive the sand must be well mixed and tempered for at least a day before using.

[The explanation on chemical grounds put forward by the author is practically untenable, and we would suggest that the damp spot on the mould surface has caused a different rate of cooling and introduced a meroscopic tear at the periphery of the chilled portion.—Ed., F.T.J.]

Firebars.—M. R. Stumper, in a recent issue of "Chaleur et Industrie," observes that if the cast iron of which firebars are made contains much phosphorus, fractures occur on heating; and phosphorus is also believed to lower the melting temperature. Chilled firebars have not proved much better, and are now rarely used. Although a low fusion point, as in cast iron, is likely to initiate combustion, sulphur in the cinder is probably the chief destructive agent, even at low temperatures, whilst silica, by dissolving iron oxide as soon as it is formed, assists the attack of oxygen. In some experiments carried out by the author analyses were made of unused firebars and after severe use, when it was found that the percentage of graphite had been reduced from about 2.5 and 3.5 per cent. to 0.3 per cent., whereas the sulphur percentage had increased from about 0.15 per cent. to nearly 6 per cent. Micrographs taken at successive stages indicate an attack on the interior of the metal along the flakes of graphite, which appear to grow gradually wider and finally to consist of bulky iron oxide, the carbon having disappeared entirely.

The Obligation of the Ironfounder to Diesel Engine Users.

Mr. H. J. Young Criticises Existing Conditions.

At a meeting of the Diesel Engine Users' Association at Caxton Hall, Westminster, London, on October 15, Mr. H. J. Young, F.I.C., read a Paper on this subject. He said that the future of Diesel engines depends upon efficient design and efficient material. Probably 90 per cent. of Diesel engine users' records to date were prejudiced because the cast irons used were never twice alike nor really designed for the job. Progress in engineering had been delayed, and is being brought to a standstill in this country by reason of the fact that the average iron foundry is working on precisely the same lines as those used before Diesel engines were introduced, and Diesel engineers to-day were taking careful records of the wear and behaviour of castings of which the material is rarely twice alike or particularly suitable for the engine.

Referring to cylinder liners and pistons, the author stated that in marine work, under superheat, the castings gave constant, often inexplicable, trouble which cropped up in engines fitted with liners made in many different foundries. The major difficulty, when attempting to investigate the matter, was that the comparative value of records was rendered useless by the fact that cylinder liners appeared to be made of anything which the cupola and the pig-irons used chose to give on the particular day the casting was made. Of many liners examined, hardly two were similar. The author thereupon set out to produce definite series of liners of definite qualities, and, by observation of their behaviour in service, it was comparatively easy to identify and to produce a suitable iron. From that time all superheated steam liners produced in the foundries concerned gave no trouble in service.

Engineer's Basic Mistake.

Few engineers, continued the author, and fewer foundries, consider the metal at all. As for making two castings—one one year and the other, say, twelve months later—so that one is indistinguishable metallurgically from the other; as for deliberately making them to any precise composition, as for attempting anything drastically new, it was no exaggeration to say that any one of these conditions is seldom attempted seriously or considered necessary. The engineer, rather than the foundryman, was to blame for the state of our foundries. The price offered for many ordinary castings had been, and still is, such as to reduce foundry work to the level of a "sweated" industry. The specification for higher class castings, for which to-day a big price is given, was unbelievably childish. There was a fiction among ironfoundrymen that one cannot work to both composition and physical test, but so false is this that the exact opposite is the truth. As far as cast iron was concerned, the engineer appeared to be dominated by the foundryman's fear of making a bad casting. This danger existed to some extent in the case of steel and all high-class alloys, but in those metals the engineer was not led astray by the fact, and insisted not only upon getting a perfect casting, but also upon the material of which it is made conforming with rigid specifications, including composition and physical properties and conditions—indeed, the three things were correlated in all metals.

Getting the Best Out of Good Iron.

In the case of Diesel castings, where the user was willing to pay a good price, the position to-day was that he rarely obtained value for money, and he could never hope to obtain it from any foundry which is not going as deeply into the matter of cast iron and employing as skilled assistance as does the Diesel engineer in the design of his own constructions. Recently the author examined some castings of a very high-priced iron. Ten small and similar castings, some used and some unused, were analysed—seven being taken off engines after having been in service and three being new ones recently made. In the most important element, viz., total carbon, there was a difference of no less than 0.48 per cent. between the highest and the lowest. Moreover, there was no particular percentage aimed at, apparently. In silicon content the variation was 0.81 per cent., and in manganese 0.41 per cent. Again no standard was to be detected and no two castings were alike.

Three large castings of the same expensive iron were examined—two new and one used. Here the results were even more amazing. The silicon content varied by 0.96 per cent., which variation caused one of the castings to contain more than twice as much silicon as one of the others, and half as much again as the third one. Most significant was the fact that the range of composition of the large and the small castings proved that the foundry was pouring both or either from whatever iron the furnace happened to be delivering when the moulds were ready.

This, contended the author, was a concrete case of the engineer paying the highest price for metal into which no knowledge or science had been put. Elementary science, he said, starts by demonstrating the vast differences between compounds and mixtures, but the word "mixture" in ironfoundry practice had stood for everything which retards progress and knowledge. Expensive pig-iron was worth using only when it is used with knowledge. Hundreds of tons of high-priced irons were purchased by foundries which need not use any, and those which should use them seldom had the knowledge to benefit from so doing and often failed to purchase the right quality for their purpose.

Continental Progress.

It was a rare experience to go into a foundry and not to find them blindly wasting money in this manner. The ordinary foundry had no need for high-priced iron, whereas the foundry making Diesel castings could benefit only if it knew what is worth paying for. Iron of guaranteed composition was always valuable provided those using it understood it, but to purchase an expensive iron on the advice of the seller and to incorporate it into a rule-of-thumb "mixture" was useless and extravagant. Progress could not be made along these lines. Due largely to Continental enterprise in applying science to industry, there was more known about cast iron with every year that passed. The trouble in this country was that long-standing lethargy had reduced our means of understanding and our power to keep pace with improvement.

Graphite and Graphite Voids.

A number of microphotographs were shown by the author demonstrating the different constitution of irons. Two of the illustrations were micrographs of similar cast irons, except that one was a high temperature furnace iron containing 2.7 per cent. total carbon, whilst the other was a cupola iron containing 3.2 per cent. It followed, therefore, said the author, that the first iron contained 0.5 per cent. less graphite or free carbon than the other; logically, the matrix of the former iron being cut up by less graphite than that of the other, it should be a much stronger metal, but actually both irons were capable of giving 17 tons tensile as a maximum. The reason for this was that the spaces containing graphite were not entirely filled and an iron might show as many or more, and as large or larger, voids as are shown by another iron containing the same or a greater amount of graphite. No longer was it scientific to estimate the comparative strength or permeability of two irons in terms of graphite—all other things being equal—because facts had proved the original theory to be wrong. In the case of the two irons mentioned, the one low in graphite content had gained no advantage because the graphite voids were as great as those of the other iron. Practically all the low carbon cast irons on the market to-day were no stronger than those containing

XUM

higher carbon—in this the author explained he was referring solely to test bars cut out of actual castings and not to separate bars cast in shape—and until something was done to remedy the cause, low carbon iron was hardly worth either making or using. The question of the size and shape of graphite voids was an intricate one involving grain size, dendritic formation and direction of gaseous flow, precipitation of dissolved gases, gaseous reactions during the formation of the graphite and while it is nascent, and the influence of other elements or compounds in the iron. Recent innovations in foundry practice had given direct evidence of our power to-day to control some of these things; incidentally, with considerable practical benefit as well as development in our knowledge of cast iron.

Neglected Opportunities.

It was for the members of the Association, continued the author, to consider whether all is well in the foundries of this country and whether they are fulfilling or are capable of fulfilling their obligations to the Diesel engine user. Not a few engine builders possessing foundries were either having their important castings made outside or were purchasing them abroad. Thus, the very foundries which should be gaining experience and giving thought to the problems involved were not asked to make the important castings. It followed that whilst large sums were being spent upon castings, those spending them were gaining no knowledge, and no progress was being made on the metallurgical side of the question—the money expended going to outside people or else abroad, instead of towards the improvement of their own foundries.

That the foundry people in the face of these facts should rest content was unbelievable; that the user of engines would need better material, and again better, was certain. The fundamental requirements of modern engineering were: (1) That ironfoundries should be capable of repeating times without limit any one casting of which the material within the casting (not in a separate test bar) is the same always in composition and physical properties as determined by analytical and physical testing and by the microscope; (2) that ironfoundries should be capable of producing castings to definite specifications of compositions and physical properties.

The obligation upon industry to prepare for the future was equally that of the ironfoundry, and in most cases it had been neglected.

Discussion.

Mr. R. T. Rolfe, in a plea for systematic control in British foundries, deprecated the manner in which mixtures were put into the cupola in many instances, and said that the results were often a perfect gamble. Before we could say which were the best irons for various purposes and could control compositions we must have a new spirit; we must have laboratories directed by qualified men, and must be prepared to pay them adequately for their services. He spoke as the head of a laboratory in which the endeavour was made to keep compositions constant from day to day, and regretted that so little had been done in that direction in the past and so little was being done now.

Mr. Young, replying, said there were some engineers who were to-day turning their attention to steel instead of cast iron; he knew of one Diesel engine works in which, as the result of many failures in cast iron, steel was being tried, but they would have many failures with steel, although they did not appear to know it. If, however, they would realise that they had never given cast iron a chance, and would pay more attention to research and scientific control, progress would be very much quicker.

Basic Data Missing.

Engineer-Commander Turner said he did not complain of the craftsmen, but of the Professors who wrote books in which he could not find the information he wanted. Some time ago he had been considering the use of cast iron for a definite purpose in connection with Diesel work, and it seemed to him that the cast iron required was one with the highest possible heat conductivity, the lowest co-efficient of expansion, the lowest modulus of elasticity possible, and the greatest mechanical strength. A search of the text books revealed that there was very little information available with regard to the co-efficient of expansion or the heat conductivity. He asked Mr. Young, therefore, where he could get proper guidance in connection with a suitable cast iron for Diesel work. Discussing the references made to lack of progress, he suggested that Diesel engineers in this country might consider concentrating upon one foundry in order to get good castings, though he would not care to say whether or not that was good politics. One important property required in a cast iron for Diesel work was immunity from the effect of gas reactions due to incomplete combustion, because in many Diesel engines working to-day combustion was far from complete, and the wear in those engines was greater than in those in which combustion was complete.

Mr. Young, replying, said there were so many factors to be considered in Diesel engines that it was almost impossible to say that, even if the composition of the cast iron were altered, the troubles experienced would be overcome, and until one could be assured that the iron was constant one could not say whether the troubles were due to design or to the cast iron itself. Three or four ranges of iron were being sent to sea, however, and in the near future we should know whether, by keeping a certain cast iron for a certain type of engine, improvement could be effected. With regard to incomplete combustion, if there were carbon deposits on the piston rings and liners, one was up against a big difficulty, and might have to use very much harder iron than in another engine. He knew of liners of very hard iron which had been at sea for eight or nine years; they contained nearly 0.25 per cent. sulphur, and he had made them to refute the suggestion that one could not make high-sulphur iron. That might possibly overcome the difficulty in connection with incomplete combustion.

Relationship of Test Bar to Casting.

Dr. W. H. Hatfield (Brown, Firth Laboratories, Sheffield), in a written communication, suggested that Mr. Young was inclined to exaggerate with regard to the production of unsuitable irons. Satisfactory castings could be made for Diesel engine purposes, but where it was important that the physical characteristics remained constant, most careful supervision was necessary. Cast iron was most difficult to deal with, because, whilst general composition could adequately and with comparative ease be controlled, just as in general metallurgical procedure, the fact remained that the ultimate characteristics of the casting depended almost entirely on the condition in which the carbon occurred. Differences in casting temperatures, speed of cooling, the nature of the mould, and the section of the casting, all very materially tended to influence whether the carbon remained in the combined or the graphitic form, and also whether the structure was fine or coarse grained. With regard to the variations in analyses of a high-priced iron, to which Mr. Young had referred in the Paper, he suggested that they were far too large to be accepted as reasonable from the commercial point of view, and did not think they represented the degree of accuracy to which British foundries worked, although it was desirable, of course, that the factors to which attention was drawn should be given more importance. He agreed that test pieces cast on to a casting were no reliable guide as to the mechanical properties of the casting itself, but, apart from the destruction of castings for test purposes, he saw no other way of dealing with the matter commercially than by adducing from the condition of the test piece the condition of the casting. It should not be assumed that the properties of the casting were identical with those of the test piece, but it could be assumed that the two bore a definite relationship, which could be worked out by trials. He agreed that iron foundries should be capable of producing castings of definite composition and physical characteristics, but he pointed out that specifications, both as to composition and physical properties, should be commercially practicable and technically possible. In his opinion, the better-equipped foundries in the country should have no difficulty in complying with the requirements of Diesel engine practice.

Too Few Controlled Foundries.

Mr. Young, dealing with the suggestion that he was inclined to exaggerate, and that properly-controlled foundries could turn out satisfactory castings, said he believed one could count on the fingers of one hand the number of properly-controlled foundries in the country. For a good many years he had held the view that the characteristics of the casting depended almost entirely upon the condition in which the carbon occurred, but to-day he was not certain of its truth. It seemed that what we had been regarding as graphite in castings was to a certain extent gaseous space, and, therefore, much depended not only on the carbon in the castings, but also on the spacing in the castings. Replying to Dr. Hatfield's criticism of the variations in analyses, the facts were that those variations of analyses were taken from castings which were being made and used to-day, not in one Diesel engine works, but in many. The iron was a very well-known and a very expensive one, and the variations seemed to continue throughout. He did not agree that in this case it was possible to assume that the properties of the casting bore a definite relationship to the properties of a test bar attached to the casting.

Mr. J. G. Griffin urged the necessity of avoiding projections, lugs, and so on, in castings, because they must necessarily produce weak spots. He also pointed out that some very good cast iron was used in some of the old Continental engines.

Mr. Young said he did not admit that founders and engineers on the Continent knew more than the British; indeed, he was rather proud to think they did not, but they were very keen, and did not scoff at the work done in other countries, but made use of it. Therefore, they were making progress where we were not. In Germany, for instance, they knew all the work he had done, but he wondered how many works in this country even knew that he existed. Referring to the effect of projections, he said that many designers knew nothing about metallurgy and designed castings with huge projections, and it was hard luck that Diesel engines should be designed without metallurgical help.

Phosphorus and Growth.

Mr. A. J. Wilson said that some years ago a number of piston covers and cylinder covers had been affected by growth and had cracked, and asked if it were due to the phosphorus in the castings.

Mr. Young did not think the phosphorus would cause growth, but certainly caused cracking. The phosphide in the iron, or some of it, remained fluid after the casting had solidified, and the phosphorus, in trying to find a place for itself, became segregated, and was distributed over the iron in patches. Since those were the most brittle parts, cracking resulted. He did not think many Diesel works were using much phosphorus, and he would reduce it to 0.1 or 0.2—almost a hematite iron—in order to avoid segregation.

Mr. T. E. Wyrill said that his experience was confined to five years' use of one Continental design of Diesel engine, and that had led him to the view that the Continental people knew more about the properties of cast iron than the British. It seemed to him that a good many of the failures experienced by British firms who were building Diesel engines of Continental design were due to their view that any cast iron was good enough.

Mr. Young said that, on the other hand, he knew one firm to-day who were building a Continental engine, and whose cast iron was better than the Continental.

The President (Mr. E. W. Johnston) considered it only fair to the British makers to mention that he had had experience of three engines which had been running for eleven years without trouble arising through faulty castings.

Mr. Wyrill pointed out that he did not wish his remarks to reflect upon British engine builders generally, and reiterated that his experience was confined to one design.

Mr. Young said it was a question of the survival of the fittest, and if we did not mend our ways we should not survive. Some Diesel engines built in this country were doing well, but a tremendous number were not, and in nine cases out of ten the failure was due to the material. That was not admitted generally, however. Engineers talked of higher temperatures and new designs, but never mentioned that they had not the proper material.

Automobile Castings are Satisfactory.

Mr. W. H. Skinner pointed out that British foundrymen could turn out wonderful castings, as evidenced by the fact that the bulk of the castings made for high efficiency motor cars were bought in this country. Probably the reason why the Diesel engine builders did not obtain castings comparable with those produced on the Continent was that the metallurgist did not get a chance to control their production. He was concerned with Sulzer engines which had been running for 10 years. The liners—which were the originals—were recently checked, and it was found that the wear at right-angles to the shaft was practically the same throughout. The cylinder heads were also intact. It was appalling to think that there was so much trouble with castings produced in this country, because in his opinion there were plenty of English firms turning out Diesel engines of superior design.

Mr. Young said he had been into one motor foundry in which everything was controlled scientifically, and they made the same iron all the year round. The marine Diesel trade, however, could not be compared with the motor-car trade, because conditions were much more severe in the former.

A New Patternmaking Material.

Patternmaking practice, as far as metal patterns are concerned, seems likely to be materially affected by the introduction of a new material, the discovery of a Birmingham firm of foundry engineers, the Constructional Engineering Company, Limited. This material, which is shortly to be placed on the market under the trade name of "Titanite," may be described as a kind of stone powder, which when mixed in the right proportions with the proper liquid, can be poured into a mould, and after allowing from four to six hours for setting, will give a pattern plate which in appearance strongly resembles marble, but with a surface which can be readily finished by means of file or sandpaper. This finish can more readily be given before the hardening process is complete, as within limits the hardness increases with the length of time which can be given for drying. The strength of the resulting patterns is one of their most valuable features, as it renders them thoroughly suitable for use in any kind of machine moulding.

An advantage of the new pattern material which will be appreciated by every foundryman is that it can be prepared in a few minutes. The method of procedure is somewhat similar to the process of making a plaster of paris pattern or mould, but it overcomes the very great drawback which attaches to the latter of having to be used the moment it is mixed. With the new Titanite stone powder, it appears that it may quite safely be left for half an hour after mixing without any ill-effects, if anything should occur to delay the pour. Thanks to the readiness with which the mixture can be prepared, a pattern plate made in the afternoon can be in active productive work on the machine the following morning.

If necessary, a certain proportion of sawdust can be used in the preparation of the new stone material, which gives the resulting compound, when set, many of the properties of a kind of moulded wood, excepting that it has, of course, no grain. It can, however, be worked in precisely the same way by ordinary woodworking or patternmaking tools. Contraction on drying is negligible.

The properties of the new material are likely to fit it for a number of other purposes for which earthenware has hitherto been used, but its appeal to the foundry trades will be principally as a pattern material, for which it presents advantages which will probably enable it largely to take the place of either metal or plaster of paris patterns. It is understood that this Titanite material was but in limited commercial production by October 20.

XUM

Mechanical Sand Riddles.

Until comparatively recently all foundry sand was riddled by hand, but the march of progress has mechanicalised the process. It would appear that the construction of an apparatus capable of performing this duty was not difficult. Yet in touring European foundries one encounters various designs of mechanical riddles, some of which are cumbersome and crude; but for all that they do serve a useful purpose in that they conserve man-energy. Recently, however, there has been the same realisation of non-universal applicability of mechanical riddles as there has been with moulding machines. In the case of moulding machines the type to be employed is decided by the nature and cost of the power available, the number to be made from any existing pattern, stripping considerations, and a host of other desiderata. So, too, with mechanical riddles. In some foundries electric power (or a lighting circuit) is available at many points, whilst in others a hand-operated machine can only be considered as no power is available. Again, according to the lay-out of the foundry, the management may insist that the power riddle must be portable, whilst another direction is equally insistent that the proper place in which to prepare sand is the shop specially set apart for this purpose.

It is with these generalities in mind that the Adaptable Moulding Machine Company has developed and placed upon the market a series of

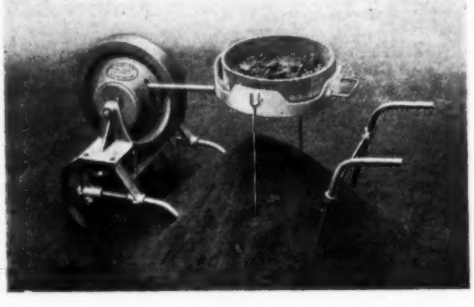


Fig. 1.—Hand-operated Portable Type of Mechanical Riddle.

different models which completely cover the field of mechanical sand riddles.

All the models have several features in common relating to the type of riddle used and its riddling action. Primarily all the machines use a standard hand riddle which can be put into or taken away from its holder whilst the machine is running. Secondly, the riddle container is of a larger diameter than the standard riddle, and permits of a backward and forward movement of the actual riddle over a bar, on which it rocks, coming in contact with a third point, which prevents the riddle falling out of the container, and at the same time gets the impact, which clears any sand from adhering to the mesh and gives a natural riddling effect, which takes place twice every revolution of the flywheel. The actual riddle being free in the container can be picked out, and any undesirable material removed from it, whilst the machine is in operation. This action undoubtedly makes for speed, as a plain rubbing action tends to clog the mesh.

Hand-operated Type.

Taking a standard 18-in. riddle, the little portable machine does eliminate the donkey work to be associated with hand riddling. It is extremely simple in operation, as a slight pull on the handle attached to the riddle container sets the power wheel in motion, which in turn keeps the riddle container oscillating. A claim is made that the machine riddles three times the quantity in the same time as against the old method. This and the other types made by this company do avoid steam and hot gases arising from hot sand being inhaled by the man holding the riddle.

Motor-driven Portable Type.

A further economy has been assured by mechanicalising the whole job by introducing a ¼ h.p. motor, whilst still maintaining portability. The machine is carried on a framework of semi-steel with wrought iron tube handles, and supported on 14 in. dia. wheels, and is very easy to move about. Attached to the part of the

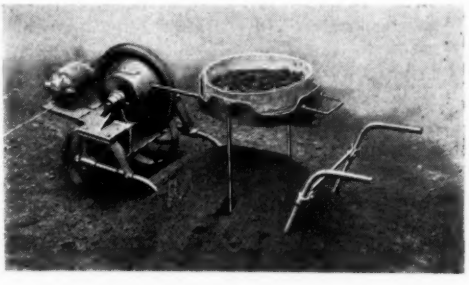


Fig. 2.—Motor-driven Portable Mechanical Riddle.

frame which rests on the ground, as shown in Fig. 2, are two springs of the helical type. These, by means of an extension piece, carry the riddle frame. To a lug fixed to the outer extremity of the riddle frame a connecting spring is anchored. To this is attached a connecting rod which is actuated by the motor through a flywheel. This flywheel is belt-driven and is mounted on a stationary shaft. It is fitted with a double ball-bearing race on one side. The elements of friction are reduced to a minimum by the riddle container being supported on two helical springs, which permit of the desired flexibility, and the unique idea of using a similar type of spring in conjunction with the connecting rod is most effective. The job is strongly built and is reasonably foolproof.

During an inspection by our representative this machine passed 1 cwt. of facing sand through a ⅛-in. mesh riddle in one minute, whilst when using a ¼-in. mesh 2 cwt. of rough floor sand was passed through easily in the same time.

Duplex Motor-driven Riddle.

Incorporating the same principles as the previous models, this type is stationary, and is ideal for incorporating amongst the sand preparing shop plant. It carries two riddles mounted on a pedestal at such a height that the riddled sand falls into a barrow or any other type of transport system. Whilst the underlying principle of the machines previously described is the taking of

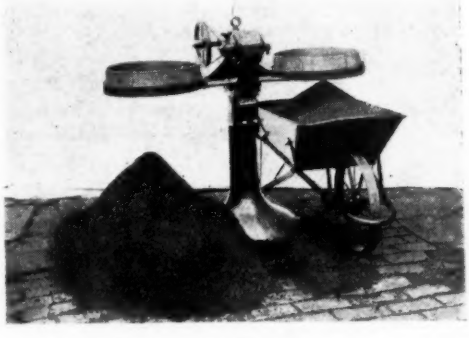


Fig. 3—A Duplex Stationary Motor-driven Riddle.

the machine to the job, the basic idea of this one is to bring the sand to the riddle and transport its output by any modern transport system.

The sum of £400 is allocated in each calendar year to the advancement of research in petroleum technology and its basic sciences, and the council of the Institution of Petroleum Technologists are prepared to receive applications for assistance from this fund.

Discussion on Mr. Smith's Address on "Fifty Years of Foundry Progress."

The Chairman (Mr. J. Masters) said Mr. Smith had shown quite plainly the progress which in many ways the foundry had made during the last half-century and the assistance which the Institute had given to people in the craft. He had provided the members with much food for thought, and there were many points likely to lead to an interesting discussion. About 15 years ago he (the Chairman) read with much interest a report of experiments carried out in America in connection with the manufacture of car wheels. The mould revolved on a table, and manganese was added. The contention was that with a centrifugally-spun mould the manganese got to the rim and formed there a hard-wearing structure, while the centre retained all the machining qualities of a soft boss. It was said to be very successful. Perhaps Mr. Smith had had that in his mind.

Vote of Thanks.

A vote of thanks to Mr. Smith for his address was moved by Mr. R. Village, Honorary Secretary of the Sheffield Branch, who recalled the fact that Mr. Smith was formerly a member of that Branch. They all recognised that great progress had been made by the industry during the period covered by Mr. Smith; evidence of it was given not only by the increase in scientific knowledge among foundrymen, but also in the fact that there was a better product. The members were profiting by the opportunities which the Institute gave. With regard to the question of sands, his view was that alumina played an important part in relation to the strength and silica in relation to the refractoriness.

Foundry Floor Must Remain of Paramount Importance.

Mr. W. H. Meadowcroft, in seconding the motion, said the foundry trade generally had been passing through a trying time, and in such circumstances it was encouraging to be able to look back and note the great progress which had been made in spite of all their difficulties. Looking to the future, there were prospects of further improvement; they were moving forward on the right lines. The formation of the Junior Section was a great step forward, and that part of the Branch's work must be cultivated carefully. Then the Institute must keep in touch with the foundry floor. In the past that was where it had been strong, and it must continue to be so. A new generation was growing up who did not know things which their elders learned long ago, and it was necessary to repeat those things. To experienced men they might appear simple, but to others they were not, and they must be explained afresh.

Mr. Smith, replying to the vote of thanks, said it had been a pleasure to prepare the Paper. Many other things might have been mentioned as illustrating the progress which had been made by the industry. Once, when classifying sands, he was told by a metallurgist that he had classified them wrongly, that the strongest sand should have been the most refractory. That was contrary to his classification. He considered that with a highly refractory sand one had to get an artificial oil binder.

He agreed with Mr. Meadowcroft's suggestion that they must keep to the foundry floor. There was a danger that concentration on the higher stages of the craft might lead to the foundry floor being somewhat ignored and ousted from its rightful place.

Science and Status.

Mr. J. S. G. Primrose said the question of lay-out was governed very largely by circumstances. Many foundries had grown up from very small beginnings, and the process of gradual development was not favourable to the adoption of the best method of lay-out.

Mr. Smith had not mentioned the question of heating. Often one heard it said that a foundry was too hot or too cold. He had been told of one very large foundry where provision was made for cooling in summer and heating in winter.

In his opinion the reason why the status of the foundryman was for a long time unduly low was the unscientific view he took of his work. When his outlook changed and progress began to be made in the acquisition of scientific knowledge and its application to foundry work his status rose not only in the eyes of the outside world but also in his own estimation. To the knowledge of scientific processes was added accumulated foundry experience, and he benefited from both. The help given to him by the Institute in this respect was one of the great things it had done. It had shown him the principles underlying his work, and had started him on a course of progressive improvement.

Centrifugal Casting Processes.

There was a point to clear up in connection with Mr. Smith's remarks on centrifugal casting where a railway carriage wheel cast in steel was mentioned as an example of the pouring of rotating moulds. Mr. Smith said because it was revolved when cast it was possible to pour it with two qualities of steel in one casting, one a hard-wearing rim or tread and the other a soft centre plate and boss. It was not correct to speak of two qualities of steel. It was one quality of steel throughout, with this difference, that at a particular stage in the process, when the metal started to enter the mould, a small amount of manganese was added in powdered form. It was only 2 per cent. This formed the hard-wearing metal of the tread. It was not a really high manganese steel. The softer centre was a slightly modified carbon steel.

The development of centrifugal casting was a subject which greatly interested one of their old members, Mr. F. Rowe, who had left the district. In a paper published in The Foundry Trade Journal recently it was shown how the internal structure, revealed microscopically, controlled the strength.

The introduction of the electric furnace as a contributing factor to the progress of foundry work had been overlooked in the Paper. In melting, purifying and refining cast iron it was of great service. Really in such cases it was a special iron.

A little might have been said about the Holley permanent mould process. In his opinion it was one of the greatest revolutions which had been made in regard to permanent moulds.

Drying Stove Practice.

Mr. Smith said he believed, in dealing with foundry conditions, he referred to heating as well as to ventilation.

His reference to free oxygen meant the oxygen in the air. In almost every heating unit one obtained a higher temperature when some unused oxygen passed into the stove. But he had in his mind a little superheater which sent into a stove so much spent air and so much unused air, this passed through a small fire and so much that did not pass through but went over the top of the fire directly into the stove. The air was supplied by a small fan. There was a very large stove which took a week or even a fortnight before really heavy moulds were dried through. They added this small superheater, which was only 2 ft. in diameter—an old boiler up-ended, with firebars put in the bottom, and the inside lined with firebricks. The difference it made was remarkable. The moulds were dried in little more than half the time it took before. In fact the superheater had to be watched closely lest it should do too much and the moulds be burned instead of being dried.

Not long ago a man who was trying one of the new heating units found he could not get the temperature up to what it should be, by about one-half. The oven was tightly closed. He removed a few of those things which made it airtight and the temperature went up, simply because there was a free air inlet. That was the sort of thing he had in mind when he spoke of free oxygen assisting drying.

In regard to mixing irons, if one could get an iron which met their requirements it was best to keep to what they knew. Of course it was sometimes necessary to mix, for instance, when they wanted a low phosphoric iron.

XUM

The omission to mention the electric furnace was an oversight. That type of furnace was very popular. It could be used with great advantage by many large foundries where machining was done. Instead of selling at a low figure their turnings and borings they could make these into any mixture they liked by means of the electric furnace.

Literary Matters.

He looked forward to a time when every Branch of the Institute would have a small library attached to it. The members should have access to a few useful foundry books. One requirement was a Foundry Dictionary. Such a thing did not exist at present as far as he knew. A few years ago a glossary of terms was included in the Annual Proceedings, but when he had occasion to look for the meaning of a certain word he could not find it there. A good, comprehensive foundry dictionary would include hundreds of things connected with the foundry, described in scientific language or in the ordinary foundry parlance.

Mr. A. L. Key said he had recollections of a reputable engineer, John Penn, who looked upon his moulders as pre-eminent; they were always paid their wages before everyone else, and others had to stand on one side when they went up to draw their money. The firm had a reputation for making a certain kind of marine engine. During the Crimean War, when they were making engines for the Government, those men were working till half-past ten at night, and every man had his supper brought down to him. John Penn did not value his moulders because they had a scientific outlook; with him it was a question of deeds, not words; he valued them for what they did. And even to-day deeds counted for more than words. The man who could do practical work, and knew a little of the chemical side, so as to be able to analyse the ordinary common elements, was the man who was wanted. The chemist, of course, had his place. His task was one of investigation, for except for the orthodox analysis there was still something which was missing, *i.e.*, that element or elements which gave irons of a similar analysis such widely different results under working conditions.

They had to deal with certain types of castings. With the knowledge they had acquired they decided that an iron of a certain composition or analysis was required. It could be obtained either by a mixture of several brands or with one brand alone. Recently, being up against a stiff proposition, he and others had a conference, and agreed on a certain analysis. It was then pointed out that one brand of pig-iron was giving better metal than others, although the analysis was the same. Now, how far could analysis be accepted as a guide to what one could expect from the materials used? Again, deeds counted more than words; if they knew an iron would hold up to working conditions satisfactorily the analysis did not matter.

It was very convenient to have a stove with whitewashed walls and an electric light to switch on, but after running up against many types of stoves, some ancient and some very modern, he could say with confidence that as far as economy was concerned his experience was that nothing was equal to the old ordinary slow-combustion stove, with an open fire and the stove closed in. He had seen them go up to 750 deg. of heat. It must be a very good modern stove that reached that mark: if 500 deg. was maintained it was a very good stove.

Stoves and Stacks.

Mr. Smith said for the little money which had been expended on the education of the moulder a good return was made, more than was made by other people on whom much more was spent.

With regard to stoves, if at the present time he were building one of the larger kinds there would be no stacks to draw their own moisture, and no flues in the bottom of the stove to take that moisture. To his mind, it was very questionable whether the stack drew away very much moisture; for instance, when there was one stack acting for five or six stoves with a long neck underneath, draught was doubtful. The method was wrong to draw the moisture to the bottom of the stove. If the moisture could not get out the mould could not dry quickly.

He agreed that the old-fashioned fire stove was excellent. The fire was put in the corner, and there was always a top plate, or a chimney at the top, to let the moisture out. He remembered some stoves which contained perhaps 150 to 200 pipe cores made of sloppy loam 9 ft. long. When the stove was fired the damper was left open at the top, and for about an hour after that the fire was going full tilt, and the steam that came out of the little chimney at the top was enough to drive an engine. If that steam and moisture were not allowed free escape it would be impossible to dry the cores in one night with the amount of coke allowed. It could not have been done if the moisture had to be drawn down to the bottom of the stove in order to take it away. Often the flues were clogged up, and instead of taking it out that way it escaped through various openings. If one could make provision for the moisture to escape during the drying period the drying period would be much less. He would have openings controlled by little shutters on the side of the stove.

Mr. H. Sherburn said Mr. Smith had not given any indication of the future. He was well qualified to prophesy, after his 50 years' experience, and perhaps during the course of the session he would give a few hints in this direction which would compensate for the omission in the address.

The foundry stove was a problem which the chemists appear to have avoided. He believed they did so designedly. Anyone who had experience of the heating of large areas, such as was found in many foundry stoves, knew that to get uniformity of temperature from top to bottom, from front to back and from side to side, was practically impossible in our present state of knowledge. It was an ideal aimed at, but no stove was known that would rigidly fulfil that ideal. It was a matter in which the chemist might come to the help of the foundryman. His view was that the trouble was mainly due to the fact that the stoves were heated by hot convection currents, whereas the natural method of heating is by radiation. In trying to heat stoves by means of heated air currents the difficulty was that the currents could not be controlled, and uniform distribution of heat became difficult.

There was an old saying "Don't put all your eggs into one basket," and the foundryman should bear it in mind in considering his supplies of pig-iron. If there were two or more sources of supply the foundryman would be in a better position, both in regard to price and delivery. In the common pig-irons two or three brands, or even more if one liked, could be used, provided they were all of the same type, and the results would be far more uniform, owing to the operation of the law of average.

What should be the attitude of the foundryman towards discoveries? Various processes were introduced, and, unfortunately, some of them were exploited with more regard to commercial considerations than for the truth, and those in charge of foundries were placed in a very difficult position. The data and results were not always easy to follow. Some types of cupolas were being offered as a wonderful improvement on present practice, which, to his knowledge, had given very poor results in certain quarters. If anyone in charge of a foundry suggested to his principals that they should go in for one or other of these innovations his reputation was at stake. So he had to be conservative. His task was to produce things, and to improve his practice if he could, but if he attempted to improve and was misled the position became very difficult.

The control of foundries calls for an increasing knowledge, for the soundest judgment and for a wide vision. The Presidential address, in its combination of sound practice with theory, and not without a spirit of adventure, should encourage the younger generation to still greater achievement.

Mr. Smith said even after more than 50 years' experience he could not say what the future was going to be. But he was convinced of one thing. In the past cast iron had been challenged and called hard names, but it was now about to come into its own.

Foundry Weighing Machines.

By "Vallishe."

It must be generally admitted that the production of good castings on an economic basis depends to a great extent on the system of weighing adopted in the foundry and throughout the works. This statement, of course, is only true if the mixing of the metal and other corresponding items are taken for granted as being correct. Not only must the system of weighing be as efficient as possible, but the apparatus used should be kept up to a high standard of accuracy.

Apparatus Used on the Charging Floor.

There are several types of weighing apparatus used on the charging floor, varying according to the class of work produced by the foundry. Perhaps the dormant pattern is most generally used, and one must admit that for medium heavy work it is very reliable. Being of heavy construction, it stands up well to rough usage. No loose weights are used, and, if desired, a continuous recording device may be readily fitted. By this method a complete and reliable record is kept of every charge, thus enabling the foundryman to check his stock of scrap, pig, coke, and other materials, and to trace easily any mistake that may arise in the weight of castings obtained.

Another type of machine is now gaining favour in the foundry. This machine was at first only used for blast furnaces, but has now been adopted for use in the foundry. In design it is more complicated than the machine previously mentioned, and consists of a series of steel-yards. Each steel-yard fills a separate purpose, say one for scrap, one for coke, one for limestone, and three for various grades of pig-iron, *i.e.*, six steel-yards in all, totally enclosed in a lock-up case. The poises are set to the various weights of each material, and a trigger on the outside of the case separately operates any one of the steel-yards corresponding to the material on the weighing platform. It may be mentioned that the materials comprising the charge may be weighed either separately or in bulk, providing each are placed on their respective platforms. Some foundries fit a special recording device for showing the exact weight of each charge, whether correct, deficient, or in excess.

Apparatus in other Parts of the Foundry.

For weighing gates, defective castings, etc., a machine of the dormant or platform type is most advisable. This should be suitably placed in the fettling shop. For weighing the finished casting at least two types of machines should be used. A weighbridge (large enough to take the wheelbase of a 4-ton lorry) for heavy castings and a portable machine for medium-weight castings. The weighbridge will, of course, serve many purposes, and should always be installed in any foundry producing on or over 40 tons per week on an average.

Machines for weighing moulding sand should be of the dormant type, fitted with angle-irons to receive the trucks containing the sand. A suitable place for such a machine is, in most cases, close to the sand-mixing department. In some foundries the molten metal itself is weighed by a special weighing device suspended on the ladle, but little need be said of this, as it is hardly a success, and, in fact, hardly a necessity in the average foundry.*

General Observations and Remarks.

It must be admitted that cleanliness is essential to the success and accuracy of any weighing machine, and yet in many foundries it is appalling to find the machines in poor condition. Rusty arms, poises, scale, etc., are the usual cases of offences. Perhaps the only time that attention is paid to the matter is a day before the appearance of the "Weights and Measures" Inspector. A general inspection every week-end would save endless of trouble and ultimate expenses.

Practically all the weighing apparatus in the foundry should be of heavy design. All bearings and recording mechanism should be suitably cased off or protected, so that no dust or dirt can accumulate in those parts. Machines which are open to the weather should receive extra attention, and it is important that levers, scale, poises, etc., should be kept well greased.

If possible, it should be made the duty of one man to attend to all weighing and the keeping in order of all the apparatus. One must admit that this would hardly be an expensive proposition, and would, without doubt, prove a blessing and a saving to those foundries who pay little or no attention to their system of weighing.

* With this we are in complete disagreement.—Editor.

Institute of British Foundrymen.

Lancashire Branch (Junior Section).

The Junior Section of the Lancashire Branch held the first meeting in the session, 1926-7, on October 23, at the Manchester College of Technology. As the President, Mr. W. Jolley, is in America, the chair was taken by the Vice-President, Mr. T. Makemson. In opening the proceedings he remarked that the Section had an exceedingly large membership and did important work; many people would not realise how important it was until a later stage in life, when they would regret that they had not profited by the oportunities offered them. It was the second Junior Section of the I.B.F., Newcastle having preceded it. Now a third had been inaugurated at Birmingham, which, he thought, was going to be a very flourishing one. It started with members of a very promising type.

The presentation of the "John Wilkinson" medal, given by Mr. J. Thewlis Johnson, was to have been made by Mr. J. Philip Bedson, who, however, was unable to attend owing to illness in his family. Mr. J. S. G. Primrose had been asked to undertake the duty. In addition to the medal, three book prizes were given, funds for that purpose having been contributed by Mr. W. Jolley and Professor E. L. Rhead, of the Manchester College of Technology. The medal and a book were awarded to Mr. J. Yates, of Bury, who received the highest number of marks at the examination last May. Mr. A. Burgess was awarded the second prize, and the third one was taken by Mr. R. Yeoman, who was the winner of the medal last year.

Mr. Primrose prefaced the presentation with a statement of three salient points in the career of John Wilkinson. Fashion founded his first success, because the dressing of the linen frills worn by the fops of the time needed a big output of flat-irons. This gave John Wilkinson his opportunity. He owed his wealth largely to war. His cannon were in great demand because of their high accuracy, and this was brought about by his use of the boring bar to hollow the solid casting. Thirdly, he showed the force of his character by becoming his own banker. He not only produced his own notes, he made his own cash in the form of silver and copper coins, and one of the copper coins was used as a model for the medal.

A vote of thanks to Mr. Primrose for his services to the Junior Section, and particularly in connection with the institution of the "John Wilkinson" medal examination, was proposed by Mr. S. G. Smith, who observed that only those who were behind the scenes knew the hard work which Mr. Primrose had done. Later in the session Mr. Primrose would make some comments on the 1926 examination paper, and all the members, but especially those who intended to sit for the examination, should hear the valuable hints he would give.

The vote of thanks was seconded by Mr. A. L. Key, who said the young men in the foundry could hardly realise at present the immense benefit that membership of the Section should give. He wished that when he was a young man the same opportunities had been open to him.

The vote of thanks was passed by acclamation.

Both the Chairman and Mr. R. W. Stubbs strongly recommended the members to attend the special classes in foundry subjects which are held at the Manchester College of Technology and in various Lancashire towns. The classes at the Manchester College of Technology are conducted by Mr. S. G. Smith.

An address (illustrated by lantern slides), entitled "The Story of Foundry Metals," was given by the Chairman.

XUM

Trade Talk.

Prospects for engineers in China were discussed by Mr. R. L. Sarjeant in a lecturette delivered before the Junior Institution of Engineers on October 15.

Dr. Robert J. Anderson has formed a limited company, to operate as a commercial testing laboratory, specialising in metals and alloys. The new laboratory, which is situated at 2,416-38, Beekman Street, Cincinnati, Ohio, is fully equipped for chemical analysis, mechanical testing, metallography, heat treatment, and radiography. The laboratory is staffed with a corps of qualified chemists and metallurgists, under direction of Dr. Robert J. Anderson, the well-known metallurgical engineer and expert on aluminum.

The Warrington Light Castings Company, Limited, have just opened new works in Napier Street, Warrington. The foundry building covers over 3,000 square yards. At the opening ceremony of the new works the Mayor of Warrington said he was pleased the directors had been happily inspired to name the foundry the "Melt-on Foundry" after his old friend Mr. Melton. He hoped the firm would progress so that in time those premises would become too small, and that they might rank as one of the foremost industries in the town. Mr. J. Fairclough, the managing director, said their business was commenced five or six years ago in a small way, and that afternoon they had seen the extension of the original business. The Mayor then tapped a furnace and made the first cast at the works.

On Monday, October 18, the Lord Mayor and Lady Mayoress of Manchester, together with Major D. Halstead, D.L., J.P., and others, visited the glassworks of Butterworth Bros., Limited, at Newton Heath, Manchester, upon the invitation of the managing director, Mr. Walter Butterworth, M.A., J.P. At the close of the visit the Lord Mayor (Councillor Miles E. Mitchell, J.P.) addressed the assembled workpeople and said that he had found the visit of extreme interest. He had known of the works for very many years and had been very glad to have the opportunity of making the visit and of learning that the firm was maintaining its position in the face of world-wide competition. He had been astonished by the remarkable nature of glass manufacture and the large number of different processes through which the glass passed in the making. He had been struck also by the way in which the whole staff and the administration were evidently working harmoniously together, and felt that it was upon this spirit in industry that the prosperity of the country depended.

The Council of the Federation of British Industries has forwarded to the Minister of Health a communication drawing his attention to the serious effect on trade caused by the high level of local taxation, and calling for a full inquiry into the subject with a view to relieving industry, particularly in the "necessitous areas." The letter states that the Federation of British Industries are much concerned as to the effects of the present industrial situation upon local taxation, and the serious results of high rates to industry. Many local authorities are finding that it is impossible to deal with the relief of distress from their own unaided resources, and are being compelled to have recourse to loans from national funds and from the banks. Whatever be the cause of the distress, high rates must be the result, and these will fall at a time when industry is least able to bear them. Moreover, as assessments are generally based upon "annual value," the amount which a firm has to find bears no relation to its capacity to pay.

Representatives of various societies which have become affiliated to the newly-formed "Industrial Peace Union of the British Empire" held their first meeting in London last week. Mr. W. L. Hichens, chairman of Cammell, Laird & Company, Limited, presided, and among the speakers were Mr. J. Havelock Wilson (president of the National Union of Seamen) and Mr. J. A. Seddon (late president of the T.U.C.). Mr. Hichens said he was extremely glad to have the opportunity of expressing his profound belief in the movement for peace in industry which was being supported by that large-hearted leader of sane trade unionism and sane industrialism, Mr. Havelock Wilson. In an attempt to solve the industrial problems the country had tried ordeal by battle, the resources of class hatred had been exploited, and the people generally had indulged in their "early morning hate" to the full extent of their desire, and what was the result? Misery, poverty, and unemployment. "Surely," continued Mr. Hichens, "it is time we rang down the curtain on this nightmare of suspicion and unreason. All of us desire to see higher wages paid in industry, greater industrial efficiency, work for all and cheaper prices, and to get those things we must work for closer co-operation between capital and labour."

Personal.

The Hon. Sir Charles A. Parsons has been awarded the Kelvin Medal, 1926.

Sir George Clark, of Workman, Clark & Company, Limited, Belfast, has been elected a director of the Bank of Ireland.

Mr. J. E. Cowen, J.P., of Walter Scott, Limited, will preside at the fifteenth annual conference of the British Commercial Gas Association in Newcastle-upon-Tyne next week.

Mr. L. R. Lewis has been elected president of the British and Latin American Chamber of Commerce. Mr. Lewis is managing director of the London offices of Lysberg & Company, Limited.

Mr. A. T. Green has been elected president of the Stoke-on-Trent Association of Engineers. He has been for the past six years Research Physicist to the British Refractories Research Association.

The Ductility of a Bronze Containing 20.0 per cent. of Tin.

Bronze containing 20 per cent. of tin is generally thought of not to be malleable neither at room temperature nor at higher temperatures. Therefore it is very interesting to know that the Chinese gongs and tamtams are made of a bronze containing about 20 per cent. of tin. To solve this problem O. Bauer and O. Vollenbruck* carried on forging and "jumping" tests with such a bronze. The raw materials were pure electrolytic copper and pure tin. The dimensions of the samples for the forging test were 10 by 10 by 80 mm. They were heated to the required temperature and then flattened by three hammer blows. The experiments were carried out at room temperature, 450 deg., 550 deg., 700 deg. to 750 deg. C. The results are summarised in the following table:—

Sample No.	Temperature deg.	Micro-texture.	
1	room temp.	$\alpha+(\alpha+\delta)$	Cracked at the first blow.
2, 3	450	$\alpha+(\alpha+\delta)$	Difficulty to be flattened; flaws and cracks.
4, 5	550	$\alpha+(\alpha+\delta)$	Could be flattened without forming cracks.
6, 7	700 to 750	$\alpha+\beta$	Could easily be flattened.

The samples for the jumping-up test were 20 mm. in height with a diameter of 20 mm. They were heated to the required temperature and jumped as much as 50 per cent. of the original height. The results are recorded in the following table:—

Temperature Deg.	Load lbs.	Jumping per cent.	Yield point Tons sq. in.	
Room temp.	73,546	broken	32.7	Cracked under the load mentioned.
,,	69,520			
470	10,450	42	6.51	No cracks formed.
470	10,450	45		
550	2,618	47	0.933	
550	2,618	47		
650	682	43	0.324	
650	682	44		

The experiments show that the bronze in question is not plastic at temperatures below 520 deg. C. (within the range of the δ-crystals). At temperatures between 520 deg. to 587 deg. C. (γ-crystals) the bronze cannot be forged but with a high consumption of energy. Within the range of the $\alpha + \beta$ crystals (at temperatures above 587 deg. C.) the bronze is easily malleable. In the semi-fluid condition (above 798 deg. C.) the alloy cracks at the slightest blow.

Eleven men were injured from an explosion of molten metal at Messrs. Head, Wrightson & Company's foundry at Thornaby last Saturday. Five of them had to be treated at the hospital for burns, but only two, William Blackett (65), Cross Street, Thornaby, and Walter Ferguson, Elizabeth Street, Thornaby, were detained. They are suffering from extensive body burns, but are progressing satisfactorily. The explosion is attributed to steam having become generated in the ladle, which contained nearly a ton of liquid metal.

* Mitteilungen aus dem Materialprüfungsamt, Berlin-Dahlem, 1926, No. 2.

"SERVICE GRC FIRST"

THE VERY BEST

IN

EVERY CLASS

OF

REFRACTORY MATERIAL

IS

ONLY JUST GOOD ENOUGH

FOR YOU

It costs little more than mediocre material, but it is worth ever so much more to you to have that feeling of confidence that the lining, or patching, or sand, will stand the heat and do the job!

WE CAN SUPPLY THE **VERY BEST** OF EVERYTHING

The GENERAL REFRACTORIES Co. Ltd., Sheffield

BCM/OK9
LONDON.

No need to try and remember our name in case it is unfamiliar to you. This is our British Monomark. Envelopes addressed simply thus will be delivered to us by arrangement with the G.P.O.

THE FOUNDRY TRADES EQUIPMENT & SUPPLIES ASSOCIATION LTD.

IRON AND STEEL MARKETS.

Pig-Iron.

MIDDLESBROUGH.—The position of the Cleveland iron trade, in its unprecedented condition of utter stagnation, has, so far as records can be traced, had no parallel in the history of the great Tees-side industry. Stocks have long since been exhausted, and the production of the two furnaces still in operation on slack blast is all but negligible in comparison with requirements. Continental iron is coming forward, but deliveries are so uncertain that very little reliance can be placed upon it. One important foundry in this district has been obliged to close down owing to the non-arrival of material bought weeks ago. In view of the extremely difficult conditions now existent, it would be obviously absurd to discuss the question of prices, which have naturally advanced to famine figures each recurring market day, Cleveland No. 3 G.M.B. foundry iron having been quoted on 'Change on October 12 at 117s. 6d. per ton, and three days later raised to 120s. per ton. There was no further advance in No. 3 at last week's market, but the price of No. 1 was increased to 125s. per ton, as compared with 122s. 6d. previously. No. 4 foundry stood at 119s. per ton, and No. 4 forge at 118s. 6d. per ton.

Conditions in the East Coast hematite market are assuming similar stringency to those described above in ordinary iron, there being no mixed numbers offering anywhere, and the price can only be put down as purely nominal at about 88s. 6d. per ton. On the North-West Coast prices are hardening, Bessemer mixed numbers being quoted at £4 16s. per ton delivered at Glasgow, £4 19s. 10d. per ton delivered at Sheffield, and £5 7s. 6d. to £5 15s. per ton delivered at Birmingham.

LANCASHIRE.—Local foundrymen are finding it increasingly difficult to maintain operations, their activities being curtailed by the high costs of production, an immediate remedy for which is not easy to prescribe. As illustrating the prohibitive levels of quotations now current, it is reported that as high as 130s. per ton, delivered Manchester or equal distance, has been asked for a small quantity of Scottish No. 3 iron. For delivery about the beginning of December, Middlesbrough No. 3 at round 132s. 6d. per ton, delivered Manchester, has been offered in small quantities.

THE MIDLANDS.—Offers of native iron in last week's Birmingham market were few and far between, prices now ruling for the usual qualities having reached impossible heights for ordinary consumers. The current quotation for Cleveland No. 3 delivered local was up to 135s. 6d. per ton, while some No. 3 Scotch was named at 125s. to 132s. 6d. per ton, also delivered.

SCOTLAND.—With the exception of a few parcels in second hands, there are no stocks now available of No. 3 foundry iron in this locality, for which holders are asking 110s. per ton, f.o.t. Founders are now experiencing difficulty in obtaining supplies to keep them going, and more inquiry is being made for hematite as a substitute. For this iron consumers are being asked to pay fully 100s. at furnaces, and the iron is going away steadily.

Finished Iron.

A South Staffordshire report states that there is a little bar iron of the best qualities being produced locally, and the price asked is round about £16 per ton. There is practically nothing in the way of crown iron obtainable from English mills, which are prepared to quote for delivery after resumption, but interest in this delivery is almost negligible. There is a fair amount of business passing to the Continental works for No. 3 iron, prices varying from £6 15s. to £7 5s. per ton, but the delivery date is somewhat protracted, owing to the foreign works' heavy commitments.

Steel.

Sheffield manufacturers are anxiously awaiting the definite end of the miners' dispute, having good orders in hand, only delayed in execution by the shortage of furnace fuel. There are very few acid or basic billets of home manufacture to be had, and the prices of these are pretty much whatever users can be induced to pay. High-carbon basic steel supplies are all but exhausted, and for Sheffield the foreign soft low-carbon variety is almost useless. Another Siemens steel furnace is about to be put into commission, and more crucible steel is being melted. In both cases, however, it is but a drop in the ocean compared with normal production. The inquiry for tinplates has improved, more business being done, with the result that some of the works have fairly full order books up to the end of the year. Prices are growing firmer on a basis of about 23s. 6d. per standard box for prompt delivery, and 21s. to 22s. for delivery after the settlement of the coal strike.

Scrap.

The prevailing dullness in the iron and steel trades is again reflected in the various markets for scrap metal, in which business is in minimum volume. In Scotland, however, a few dealings are reported in foundry material, machinery cast-iron scrap in pieces not exceeding 1 cwt., and suitable for foundries, including heavy ordinary cast-iron scrap to the same specification, being really the only classes of scrap moving. These are being disposed of around 80s. to 82s. 6d. and 72s. 6d. to 75s. per ton respectively. In some quarters it is very difficult to obtain machinery cast, and naturally good prices are being paid. Old cast-iron railway chairs remain fairly firm around 80s. per ton, and light cast-iron scrap at 60s. per ton. The foregoing prices are all delivered f.o.t. consumers' works.

Metals.

Copper.—Movements in the standard market during the past week were of somewhat spasmodic character, the favourable views first entertained by operators as to the result of the formation of the American Copper Exporters' Association having been to some extent discounted by the effect of New York advices. While the statement that the promoters do not intend to force up the price to an uneconomic level has received due consideration, the argument is advanced that nobody is likely to attempt to corner the metal when the effect of the previous Secretan movement is remembered.

Official closing prices of standard copper have been as follow :—

Cash : Thursday, £58 7s. 6d. to £58 10s. ; Friday, £58 10s. to £58 12s. 6d. ; Monday, £58 7s. 6d. to £58 10s. ; Tuesday, £58 2s. 6d. to £58 5s. ; Wednesday, £58 10s. to £58 12s. 6d.

Three Months : Thursday, £59 5s. to £59 7s. 6d. ; Friday, £59 5s. to £59 7s. 6d. ; Monday, £59 5s. to £59 7s. 6d. ; Tuesday, £59 to £59 2s. 6d. ; Wednesday, £59 7s. 6d. to £59 10s.

Tin.—The unfavourable effect of restricted buying on American account in the standard tin market has been reflected in an easier tendency of prices, which declined by nearly £10 during the past week. It is interesting to note that at one time the price rose to the new high level since 1920 of £321 buyers. The average price for the first nine months of the year has been £285, against £261 during the whole of the previous year. The demand on home and Continental account has shown renewed activity, while the Welsh tinplate mills are now running at fully 50 per cent. of capacity.

Official closing prices of standard tin have been as under :—

Cash : Thursday, £309 5s. to £309 10s. ; Friday, £310 to £310 10s. ; Monday, £310 10s. to £310 15s. ; Tuesday, £306 to £306 5s. ; Wednesday, £306 10s. to £306 15s.

Three Months : Thursday, £303 10s. to £303 15s. ; Friday, £304 10s. to £304 15s. ; Monday, £304 15s. to £305 ; Tuesday, £301 10s. to £301 15s. ; Wednesday, £302 5s. to £302 10s.

Spelter.—More activity has been the rule in the spelter market of late, the actual consumption of zinc being much better than for other metals. The business placed by consumers has continued on a moderately good scale, and this, with the addition of comparatively heavy speculative operations, has caused the metal to assume quite an aspect of strength.

The following are the week's prices :—

Ordinary : Thursday, £34 2s. 6d. ; Friday, £34 6s. 3d. ; Monday, £34 2s. 6d. ; Tuesday, £33 16s. 3d. ; Wednesday, £34.

Lead.—The market for soft foreign pig had developed a stronger position until the 19th inst., when liberal offerings were only slowly absorbed, and values consequently eased. Although consumers have shown no more readiness than lately to buy other than from hand to mouth, the market has been assisted by a technical position, which evidences a shortage of near-by metal, and that was what caused the recent strength.

The week's prices are appended :—

Soft foreign (prompt) : Thursday, £30 10s. ; Friday, £30 15s. ; Monday, £30 11s. 3d. ; Tuesday, £30 6s. 3d. ; Wednesday, £30 7s. 6d.

COLTNESS IRON CO., LTD.

Makers of the well-known and old-established

"COLTNESS" BRAND OF HIGH CLASS SCOTCH PIG IRON

FOUNDRY. No. 1, No. 3, No. 4. } **STANDARD GRADES** { HEMATITE. No. 1, No. 3, No. 4.

Works:— Newmains, Lanarkshire.

PRICES, ANALYSES, ETC., MAY BE OBTAINED ON APPLICATION TO THE GLASGOW OFFICE.

Office:— 75, Bothwell St., Glasgow, C.2.

ADVICE GIVEN FREE

"STEINERT" (PATENT) MAGNETIC IRON SEPARATORS

The last word in Efficiency, Design and Construction of Magnetic Separators.

All Types and Sizes Made to Suit Clients' Requirements.

Sole British Selling Agents:

T. FEARNLEY ALLEN & SON

51, Norwich Union Chambers, Congreve Street, Birmingham.

Telephone: Central 543.
Telegrams: "Sandblo," Birmingham.

Ground Ganister,
Steel Moulders' Composition,
Silica Bricks, Refractory Goods.

PICKFORD, HOLLAND & Co., Ld., SHEFFIELD.

WEEKLY PRICE CURRENT.

COPPER.

	£	s.	d.
Standard cash ..	58	10	0
Three months ..	59	7	6
Electrolytic	66	10	0
Tough	64	5	0
Best selected ..	64	15	0
Sheets	92	0	0
India	73	10	0
Wire bars	67	0	0
Do. November ..	66	17	6
Do. December ..	66	17	6
Ingot bars	66	17	6
H.C. wire rods ..	70	10	0
Off. av. cash, Sept.	58	15	4 1/2
Do., 3 mths. Sept.	59	10	4 1/2
Do., Sttlmnt, Sept.	58	15	0
Do., Electro, Sept.	66	14	6 1/2
Do., B.S., Sept. ..	65	9	4 1/2
Aver. spot price copper, Sept. ..	58	15	0
Do., wire bars, Sept.	66	18	6 1/2
Solid drawn tubes			13d.
Brazed tubes ..			13d.
Wire			9 3/4d.

BRASS.

Solid drawn tubes ..	12d.
Brazed tubes	13 1/2d.
Rods, drawn	11 1/2d.
Rods, extd. or rlld. ..	7 1/2d.
Sheets to 10 w.g ..	10 1/2d.
Wire	10 1/2d.
Rolled metal	10 1/2d.
Yellow metal rods ..	7 1/2d.
Do. 4 × 4 Squares	8d.
Do. 4 × 3 Sheets ..	8 1/2d.

TIN.

	£	s.	d.
Standard cash ..	306	10	0
Three months ..	302	5	0
English	304	10	0
Bars	306	0	0
Straits	313	10	0
Australian		—	
Eastern	311	5	0
Banca		—	
Off. avr. cash, Sept.	306	8	9
Do., 3 mths. Sept.	298	5	7 1/2
Do., Sttlmt. Sept.	306	7	0 1/2
Aver. spot., Sept.	306	8	9

SPELTER.

Ordinary	34	0	0
Remelted	32	15	0
Hard	27	5	0
Electro 99.9 ..	36	7	6
English	34	12	6
India	30	5	0
Zinc dust	43	0	0
Zinc ashes	16	0	0
Off. aver., Sept...	34	8	0 1/2
Aver., spot, Sept.	34	7	9 1/2

LEAD.

Soft foreign ppt.	30	7	6
English	31	15	0
Off. average, Sept.	31	18	9
Average spot, Sept.	32	1	8 1/2

ZINC SHEETS, &c.

Zinc sheets, English	42	15	0
Do. V.M. ex whf.	39	15	0
Rods	45	0	0
Boiler plates ..	39	0	0
Battery plates ..	38	10	0

ANTIMONY.

Special brands, Eng.	74	10	0
Chinese	60	0	0
Crude	39	0	0

QUICKSILVER.

Quicksilver ..	16	15	0

FERRO-ALLOYS AND STEEL-MAKING METALS.

Ferro-silicon —

25%	9	2	6
45/50%	10	0	0
75%	15	17	6

Ferro-vanadium—
35/40% 14/- to 14/6 lb. va.

Ferro-molybdenum—
70/75% c. free .. 5/3 lb.

Ferro-titanium—
23/25 % carbonless 11 1/2d.

Ferro-phosphorus, 20/25%, £17 0 0

Ferro-tungsten—
80/85%, c.fr. .. 1/5 lb.

Tungsten metal powder—
98/99% 1/9 to 1/10 lb.

Ferro-chrome—

2/4% car. ..	£33	0	0
4/6% car. ..	£23	0	0
6/8% car. ..	£21	15	0
8/10% car. ..	£20	15	0

Ferro-chrome—

Max. 2% car.	£37	0	0
Max. 1% car.	£43	5	0
Max. 0.70% car.	£54	0	0
70%, carbonless	1/5 lb.		

Nickel—99%, cubes or pellets .. £170

Cobalt metal—98/99% 10/- lb.

Aluminium 98/99% £107 to £112

Metallic Chromium—
96/98% .. 3/- lb.

Ferro-manganese (net)—

76/80%, loose	£15	0	0
76/80%, packed	£16	0	0
76/80%, export	£15	0	0

Metallic manganese—
94/96%, carbonless 2/- lb.
Per ton unless otherwise stated.

HIGH-SPEED TOOL STEEL.

	s.	d.
Finished bars, 14% tungsten ..	2	6
Finished bars, 18% tungsten ..	3	0

Per lb. net, d/d buyers' works.

Extras—
Rounds and squares 3 in. and over .. 4d. lb.
Rounds and squares under 1/4 in. to 1/4 in. 3d. lb.
Do. under 1/4 in. to 1/8 in. .. .. 1/- lb.
Flats, 1/4 in. × 1/4 in. to under 1 in. × 1/8 in. 3d. lb.
Do. under 1/4 in. × 1/4 in. 1/- lb
Bevels of approved sizes and sections 6d. lb.
Bars cut to length 10% extra

Scrap from high-speed tool steel—
Scrap pieces .. .. 3d.
Turnings and swarf 1d.
Per lb. net, d/d steel makers' works.

SCRAP.

South Wales—£ s. d. £ s. d.
Hvy. steel 2 12 6 to 3 0 0
Bundled steel & shrngs. 2 5 0 to 2 7 6
Mixed iron & steel 2 7 6 to 2 12 6
Heavy cast iron 2 15 0 to 3 0 0
Good machinery for foundries 3 0 0 to 3 5 0

Cleveland—

Heavy steel ..	3	0	0
Steel turnings ..	2	7	6
Cast iron borings	2	5	0
Heavy forge ..	4	2	6
Bushelled scrap	3	10	0

Cast-iron scrap 3 8 0 to 3 10 0

Lancashire—
Cast-iron scrap 3 7 6 to 3 10 0
Hvy. wrought .. 3 2 6
Steel turnings .. 2 2 0

London — Merchants' buying prices delivered yard.

Copper (clean)..	49	0	0
Brass (clean) ..	38	0	0
Lead (less usual draft) ..	27	10	0
Tea lead ..	23	10	0
Zinc	23	10	0
New aluminium cuttings ..	84	0	0
Braziery copper	45	0	0
Gunmetal ..	47	0	0
Hollow pewter	200	0	0
Shaped black pewter ..	150	0	0

PIG-IRON.

(*f.o.t. unless otherwise stated*).

N.E. Coast—

Foundry No. 1 ..	125/-
Foundry No. 3 ..	120/-
Foundry No. 4 ..	119/-
Forge No. 4	118 6
Hematite No. 1 ..	89/-
Hematite M/Nos. ..	88/6

N.W. Coast—
Hem. M/Nos. d/d Glas. 96/
„ d/d Birm. 107/6 to 115/-

Midlands—

Staffs common* ..	—
„ No. 4 forge ..	—
„ No. 3 foundry ..	—
Shrops. basic	—
„ Cold blast, ord.*	—
„ „ roll iron* ..	—

* d/d Birmingham.

Northants forge	—
„ fdry No. 3 ..	—
Derbyshire forge	—
„ fdry. No. 3 ..	—
„ basic	—

Scotland—

Foundry No. 1 ..	—
„ No. 3 ..	110/-
Hem. M/Nos. ..	—

Sheffield (d/d district)—

Derby forge	—
„ fdry. No. 3 ..	—
Lincs. forge	—
„ fdry. No. 3 ..	—
E.C. hematite	—
W.C. hematite ..	99/-

Lincs. (at furnaces)—

Forge No. 4	—
Foundry No. 3.. ..	—
Basic	—

Lancashire (d/d eq. Man.)—

Derby forge	—
„ fdry. No. 3 ..	—
Northants foundry No. 3	—
Dalzell, No. 3	130/-
Summerlee, No. 3 ..	130/-
Glengarnock, No. 3 ..	130/-
Gartsherrie, No. 3 ..	130/-
Monkland No 3	130/-
Coltness, No. 3	130/-
Shotts, No. 3	130/-

FINISHED IRON & STEEL.

Usual District deliveries for iron; delivered consumers' station for steel.

Iron—	£	s.	d.	£	s.	d.
Bars (cr.) nom. ..						
	12	0	0 to	13	10	0
Angles				12	0	0
Tees to 3 united ins.				12	10	0
Nut and bolt iron				—		
Hoops				14	10	0
Marked bars (Staffs.) f.o.t. ..				14	0	0
Gas strip				12	10	0
Bolts and nuts .. 3/4 in. × 4 in. ..				15	5	0
Steel—						
Ship plates				8	12	6
Boiler plts. ..				11	5	0
Chequer plts. ..				9	15	0
Angles				7	12	6
Tees				8	12	6
Joists				7	12	6
Rounds and Squares 3 in. to 5 1/2 ins. ..				9	7	6
Rounds under 3 in. to 1/4 in.				9	0	0
Flats, over 5 in. wide and up ..				9	17	6
Flats, 5in. to 1 1/2 in.				8	17	6
Rails, heavy ..				8	10	0
Fishplates				12	10	0
Hoops (Staffs.) ..				10	10	0
Black sheets, 24g.				12	2	6
Galv. cor. sheets, 24g.				17	0	0
Galv. fencing wire 8g. plain				12	10	0
Billets, soft ..				7	15	0
Billets, hard ..				8	2	6
Sheet bars				7	10	0
Tin bars d/d.. ..				7	10	0

PHOSPHOR BRONZE.

	Per lb.	basis.
Strip	1	3
Sheet to 10 w.g. ..	1	3 1/2
Wire	1	4
Rods	1	3
Tubes	1	8
Castings	1	2

Delivery 3 cwt. free
10% phos. cop. £40 above B.S.
15% phos. cop. £50 above B.S.
Phosphor tin (5%) £30 above price of English ingots.
C. Clifford & Son, Limited.

NICKEL SILVER, &c.

	Per lb.
Ingots for raising	9d. to 1/3
Rolled—	
To 9 in. wide	1/3 to 1/9
To 12 in. wide	1/3 1/2 to 1/9 1/2
To 15 in. wide	1/3 1/2 to 1/9 1/2
To 18 in. wide	1/4 to 1/10
To 21 in. wide	1/4 1/2 to 1/10 1/2
To 25 in. wide	1/5 to 1/11
Ingots for spoons and forks ..	9d. to 1/5 1/2
Ingots rolled to spoon size ..	1/- to 1/8 1/2
Wire round—	
3/0 to 10 G.	1/6 1/2 to 2/1 1/2

with extras according to gauge.

AMERICAN IRON & STEEL.

At Pittsburgh unless otherwise stated.	Dols.
No. 2X foundry, Phila.	21.76
No. 2 foundry, Valley	20.26
No. 2 foundry, Birm.	20.00
Basic	19.76
Bessemer	20.76
Malleable	20.26
Grey forge	19.76
Ferro-mang. 80% d/d	88.00
Bess. rails, h'y, at mill	43.00
O.-h. rails, h'y at mill	43.00
Bess billets	35.00
O.-h. billets	35.00
O.-h. sheet bars ..	36.00
Wire rods	45.00
	Cents.
Iron bars, Phila. ..	2.22
Steel bars	2.00
Tank plates	1.90
Beams, etc.	2.00
Skelp, grooved steel ..	1.90
Skelp, sheared steel ..	1.90
Steel hoops	2.50
Sheets, black, No. 24..	3.00
Sheets, galv., No. 24 ..	3.85
Sheets, blue an'l'd, 9 & 10	2.30
Wire nails	2.65
Plain wire	2.50
Barbed wire, galv. ..	3.35
Tinplate, 100 lb tox	$5.50

COKE (at ovens).

Welsh foundry	—
„ furnace	—
Durham & North.	
„ foundry	—
„ furnace	57/6
Other Districts, foundry	—
„ „ furnace (basis)	—

TINPLATES.

f.o.b. Bristol Channel ports.

I.C. Cokes,	20 × 14, box	22/4 1/2
„	28 × 20, „	44/9
„	20 × 10, „	—
„	18 3/4 × 14, „	—
C.W.	20 × 14, „	—
„	28 × 20, „	—
„	20 × 10, „	—
„	18 3/4 × 14, „	—

Terneplates 28 × 20, — per box basis f.o.b.

SWEDISH IRON.

Bars, hammered	£18/10 to £19/0
Rolled Ord.	£15/10/0 to £16
Nail rods	£16 5 0 to £16 15 0
Keg. steel nom.	£33 to £35
Faggot steel nom.	£22 to £25
Blooms, according to quality	£9 to £12
Pig-iron	£6 0 0 to £6 10 0

all f.o.b. Gothenburg.

TUBES AND FITTINGS.

Up to and incl. 6 in.

	Tubes	*Fittings*
Gas ..	60%	.. 50%
Water ..	55%	.. 45%
Steam ..	50%	.. 40%

W.I. 10% extra.

DAILY FLUCTUATIONS.

Standard Copper (Cash).

	£	s.	d.	
Oct. 21	58	7	6	inc. 2/6
,, 22	58	10	0	,, 2/6
,, 25	58	7	6	dec. 2/6
,, 26	58	2	6	,, 5/-
,, 27	58	10	0	inc. 7/6

Electrolytic Copper.

	£	s.	d.	
Oct. 21	66	10	0	No change
,, 22	66	10	0	,, ,,
,, 25	66	10	0	,, ,,
,, 26	66	10	0	,, ,,
,, 27	66	10	0	,, ,,

Standard Tin (Cash).

	£	s.	d.	
Oct. 21	309	5	0	dec. 40/-
,, 22	310	0	0	inc. 15/-
,, 25	310	10	0	inc. 10/-
,, 26	306	0	0	dec. 90/-
,, 27	306	10	0	inc. 10/-

Tin (English ingots).

	£	s.	d.	
Oct. 21	307	5	0	dec. 40/-
,, 22	308	0	0	inc. 15/-
,, 25	308	10	0	,, 10/-
,, 26	304	0	0	dec. 90/-
,, 27	302	5	0	,, 35/-

Zinc Sheets (English).

	£	s.	d.	
Oct. 21	42	15	0	No change
,, 22	42	15	0	,, ,,
,, 25	42	15	0	,, ,,
,, 26	42	15	0	,, ,,
,, 27	42	15	0	,, ,,

Spelter (ordinary).

	£	s.	d.	
Oct. 21	34	2	6	dec. 2/6
,, 22	34	6	3	inc. 3/9
,, 25	34	2	6	dec. 3/9
,, 26	33	16	3	,, 6/3
,, 27	34	0	0	inc. 3/9

Lead (English).

	£	s.	d.	
Oct. 21	31	15	0	dec. 5/-
,, 22	32	0	0	inc. 5/-
,, 25	31	15	0	dec. 5/-
,, 26	31	10	0	,, 5/-
,, 27	31	15	0	inc. 5/-

BLAST-FURNACE STATISTICS.

Furnaces in Blast at the close of each Quarter making Pig-iron Specified.

Quarter ending.	Hematite.	Forge and foundry.	Basic.	Ferro-manganese	Total in blast.
1912					
March ..	16	26	7	6	55
June ..	103	163	47	12	325
September	113	170	49	15	347
December ..	115	171	49	15	350
1913					
March ..	118 2/3	169	52	18 1/3	358
June ..	117	163	50	14	344
September	107	157	47	13	324
December ..	91	154	55	13	293
1914					
March ..	96	146	47	11	300
June ..	90	143	45	12	290
September	94	133	41	15	286
December ..	100	136	46	12	294
1915					
March ..	102	130	52 2/3	10	294
June ..	103	126 1/3	54 2/3	10	294
September	105	117 1/3	52 2/3	11	287
December ..	108	111 1/3	50 2/3	15	284
1916					
March ..	116	106 1/3	50 2/3	12	285
June ..	120	106	54	13	293
September	124	107	58	13	302
December ..	126	110	57	18	311
1917					
March ..	131	111	62	16	320
June ..	129	116	70	15	324
September	123	102	78	19	322
December ..	118	99	85	13	315
1918	117	102	92	15	326
March ..	120	108	86	16	330
June ..					
September	120	104	83	14	321
December ..	113	108	72	15	308
1919					
March ..	98	109	69	13	289
June ..	97	107	78	7	289
September	66	99	53	5	223
December ..	77	113	62	8	260

Quarter ending.	Hematite.	Forge and foundry.	Basic.	Ferro-manganese	Total in blast.
1920					
March	92	108	72	10	282
June ..	97	119	68	12	296
September	93	122	73	12	300
December ..	77	125	59	13	274
1921					
March ..	36	70	10	3	119
June ..	—	1	—	—	1
September	17	41	10	—	68
December ..	22	41	15	3	81
1922 ..					
March ..	31	46	23	7	107
June ..	25	55	28	9	117
September	27	74	27	10	138
December ..	46	83 1/3	30 2/3	10	170
1923					
March ..	52	93	45	10	200
June ..	62	103	45	13	223
September	38	98	42	11	189
December ..	50	99	49	9	207
1924 ..					
March ..	45	94 2/3	51 1/3	10	201
June ..	45	91	46	8	190
September	44	85	38	5	172
December ..	42	87	31	7	167
1925 ..					
March ..	40	84	36	9	169
June ..	31	76	32	9	148
September	28	67	30	5	130
December ..	38	74	32	4	148
1926					
March ..	39	79	33	4	155
June ..	3	5	4	2	14
September	1	4	—	—	5

WILLIAM JACKS & COMPANY,

WINCHESTER HOUSE, OLD BROAD ST., LONDON, E.C.2.

18, BENNETTS HILL, BIRMINGHAM.

18, BENNETTS HILL, BIRMINGHAM.
11, OLD HALL STREET, LIVERPOOL.
EXCHANGE BLDGS., PORT TALBOT.
FOWLERS BUILDINGS, BOMBAY.
CLIVE STREET, CALCUTTA.
ANGAPPA NAICK STREET, MADRAS.

REGISTERED TRADE MARK
LIMPET

1, HONG KONG ROAD, SHANGHAI.
OCEAN BUILDING, SINGAPORE.
JAVA STREET, KUALA LUMPUR
5, SHAFFRAZ ROAD, RANGOON.
COX'S BUILDINGS, KARACHI.
P.O. BOX 1580, CAIRO.

PIG IRON

SCOTCH, MIDDLESBRO', HEMATITE, BASIC, SPECIALS, &c.,

NON-FERROUS METALS

COPPER, TIN, LEAD, SPELTER, ANTIMONY, CHROME ORE

WILLIAM JACKS & COMPANY,

19, ST. VINCENT PLACE, GLASGOW.

ZETLAND ROAD, MIDDLESBROUGH.

SMALL ADVERTISEMENTS.

Notice.

Small Advertisements in this section of the Journal are accepted at the prepaid rate of 6d. per line, first line in capitals counting two, average 7 words per line. Minimum charge for one insertion 3/-.

SITUATIONS VACANT AND WANTED.

FOREMAN or Assistant Patternmaker, wood and metal, desires change; 9 years' Assistant, 12 years' experience of Aircraft Engine patterns; specialised in air- and water-cooled aluminium cylinders, good practical foundry knowledge, conversant with all up-to-date methods of plate and machine moulding; capable of handling men; good references.—Apply, Box 834, Offices of The Foundry Trade Journal, 49, Wellington Street, Strand, London, W.C.2.

REPRESENTATIVES required for large firm of Foundry Plant Manufacturers; part expenses and good commission given to the right type of Representative who can influence business. State full particulars and area covered.—Box 842, Offices of The Foundry Trade Journal, 49, Wellington Street, Strand, London, W.C.2.

BRASS FOUNDRY CHARGEHAND. — Modern Brass Foundry in the Midlands has a vacancy for an up-to-date Chargehand; must be fully experienced in the economical production of large and complicated Gun Metal Castings.—Apply, stating age, fullest details of experience and salary required, to Box 852, Offices of The Foundry Trade Journal, 49, Wellington Street, Strand, London, W.C.2.

CUPOLA MAN wanted, at Northampton, to operate a Pneulec Cupola melting five tons per hour, to commence in December; the engagement of Cupola Man and Mate used to Light Castings work is desirable.—Applications to be made in first instance to Pneulec, Limited, Mafeking Road, Smethwick.

FOREMAN PATTERNMAKER, with good Foundry knowledge, desires post; 19 years full control of Pattern Shop with first-class firm, who are giving up the manufacture of Machinery, Marine, Hydraulic and General Engineering.—Box 854, Offices of The Foundry Trade Journal, 49, Wellington Street, Strand, London, W.C.2.

FINANCIAL.

WANTED, an Engineering Firm using a fair amount of Iron Castings, to take an interest in an Iron Foundry casting from 30 cwts. to 2 tons daily.—Apply, Box 832, Offices of The Foundry Trade Journal, 49, Wellington Street, Strand, London, W.C.2.

PUBLICATION.

IRON, STEEL, BRASS AND ALUMINIUM FOUNDERS, MANUFACTURING ENGINEERS, MAKERS OF FOUNDRY PLANT AND REQUISITES, REFRACTORIES.

The 1926 Edition of "RYLANDS," now on sale, covers all branches of these industries, in addition to many others. Order your Copy now. Price 42s. cloth, 52s. morocco. Industrial Newspapers, Ltd., 49, Wellington Street, Strand, London, W.C.2.

PATENTS.

THE PROPRIETOR of British Patent Nos. 191875 and 192677 (Div.), both dated November 1, 1921, and both relating to "Improvements in a Foundry Sand Mixer," is desirous of entering into arrangements by way of a licence or otherwise on reasonable terms for the purpose of exploiting the above patents and ensuring their practical working in Great Britain.—All inquiries to be addressed to B. Singer, Steger Building, Chicago, Illinois.

MACHINERY.

SAND MIXERS.—New and second-hand. Ask us to quote.—W. Brealey & Company, Limited, Prospect Works, Hawksley Avenue, Sheffield.

ADAPTABLE MOULDING MACHINES; four required; must be in good condition. State price.—Box 850, Offices of The Foundry Trade Journal, 49, Wellington Street, Strand, London, W.C.2.

FOR SALE, two Portable Coke-fired Core Ovens, with five shelves, 50 x 30 inches; in perfect condition.—Bergius, 254, Dobbie's Loan, Glasgow.

FURNACE ELECTRIC TRANSFORMERS; four for Sale; 250 K.V.A., single-phase, 10,000/70 volts.—Britannia Mfg. Co., Ltd., 22/26, Britannia Street, City Road, N.1.

MACHINERY.—*Continued.*

SAND MIXER (second hand), Blade type, complete with gearing and ready for use; £18, free on rail Sheffield.—Box 848. Offices of The Foundry Trade Journal, 49, Wellington Street, Strand, London, W.C.2.

ONE 15-TON BOTTOM-POURING LADLE, complete with Tipping Gear; maker, Stevensons; absolutely new and in perfect condition; can be seen any time; very cheap.—Apply Box 836, Offices of The Foundry Trade Journal, 49, Wellington Street, Strand, London, W.C.2.

THREE CAST-IRON REGENERATIVE HARDENING AND ANNEALING GAS FURNACES, by Davis, 4 ft. 9 in. x 2 ft. 9 in. x 1 ft. 6 in. clear, complete with equipment (two have never been used). Also one A.C.I. Low-pressure Gas Furnace, by John Wright; 4 ft. 6 in. x 2 ft. 3 in. x 1 ft. clear, complete with equipment.—Liquidator, Box 856, Offices of The Foundry Trade Journal, 49, Wellington Street, Strand, London, W.C.2.

MISCELLANEOUS.

PATTERNS.—Inquiries solicited; quotations by return; shop equipped with modern machinery; quick delivery.—Cleghorn & Company, Midland Pattern Works, Spring Gardens, Worcester. Phone 264.

CORE GUM.—You cannot be satisfied with anything but the best. We have two economical grades which you should inspect.—Write Lawson Walton & Co., Ltd., Newcastle-on-Tyne.

RED IRON-OXIDE PAINTS, ready for use; the best paint for Iron Works; cwt., 27s. 6d.; 4-cwt. lots at 25s., carriage paid.—William Olsen, Limited, Cogan Street, Hull.

COMPREHENSIVE range of Patterns, Core Boxes and Moulding Boxes, etc., for R.W. Pipes, H.R. and O.G. Gutters and Fittings for Disposal.—John Hill & Sons, Dominion Works, Stourbridge.

FOUNDRYMEN, Steel Workers, Metallurgists and Chemists should be in possession of the Vest Pocket Microscope. This powerful little scientific instrument is sent post free 8s. 6d. each; remittance should accompany order to Sulron, Ltd., Haxworth Chambers, 25, Figtree Lane, Sheffield. The ideal instrument for examining fractures of materials.

TROUBLED WITH WASTERS? If so, try "Ferromol" desulphurisor and see the wonderful improvement it makes to your metal; just the thing to counteract the sulphurous coke being sold at present.—T. E. Gray & Co., Ltd., 119, High Holborn, London, W.C.1.

MOULDING BOX for Sale; 14 ft. long x 4 ft. 2 in. wide x 8½ in. deep, 1 in. thick; approximate weight 35 cwt.; excellent condition; £10.—Can be seen at The Rodney Foundry Co., Ltd., Hughes Fields, Deptford Green, S.E.8.

IMPORTED FOUNDRY COKE for delivery at Humber Ports. Prices on application to:—
G. R. CAWOOD & CO., LTD.,
4, SOUTH PARADE,
LEEDS.
Telephone: 20074. Telegrams: Ransford.

WORM & BEVEL GEARED CRANE LADLES

NEW ½ ton, enclosed Gears, latest type	£13
NEW 1 ton, enclosed Gears, latest type	£20
NEW 2 ton, by Thwaites	£25
NEW 2½ ton, by Geo. Green	£30
12 ton, by James Evans & Co.	£75

LARGEST STOCK OF FOUNDRY PLANT IN ENGLAND

PLEASE SEND FOR LIST.

BUY FROM ME AND SAVE MONEY.

ALEX. HAMMOND. *FOUNDRY MACHINERY MERCHANT,*
14, AUSTRALIA ROAD, SLOUGH.